



Economic Impacts Associated with  
Potential Critical Habitat Designation  
for the Southern Resident Population  
of Killer Whales

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## EXECUTIVE SUMMARY

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The purpose of this report is to identify and analyze the potential economic impacts associated with the potential critical habitat designation for the southern resident killer whales (whales) in Puget Sound.

On May 29, 2003, NOAA Fisheries classified the whales' stock as "depleted" under the Marine Mammal Protection Act (MMPA). On December 22, 2004, NOAA Fisheries proposed to list the whales as threatened under the Endangered Species Act (ESA). The proposed listing rule (PR) did not formally propose critical habitat for the distinct population, but did solicit comment on issues pertaining to the listing, including data to support critical habitat designation.

NOAA Fisheries is considering approximately 2,676 square miles in three specific areas within the Puget Sound region for potential critical habitat designation as follows:

- **Area 1: Core Summer Area-** This area include the Georgia Strait from the Canadian Border south to Deception Pass Bridge (916 square miles).<sup>1</sup>
- **Area 2: Fall/Winter Area-** This includes the inland waterways of Puget Sound south of Deception Pass Bridge, excluding Hood Canal (859 square miles).
- **Area 3: Strait of Juan de Fuca-** This area includes the U.S. waters of the Strait (901 square miles).

These areas, highlighted in Exhibit ES-1, are adjacent to 12 counties in Washington State, including the cities of Seattle and Tacoma.

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<sup>1</sup> The number of square miles within each area is a rough estimate as NOAA Fisheries is considering only areas in which water depth is 20 feet or greater. Additionally, the estimated area of Area 1: Core Summer Area includes the area of the islands contained within this area.

Exhibit ES-1

POTENTIAL CRITICAL HABITAT FOR THE SOUTHERN RESIDENT KILLER WHALES

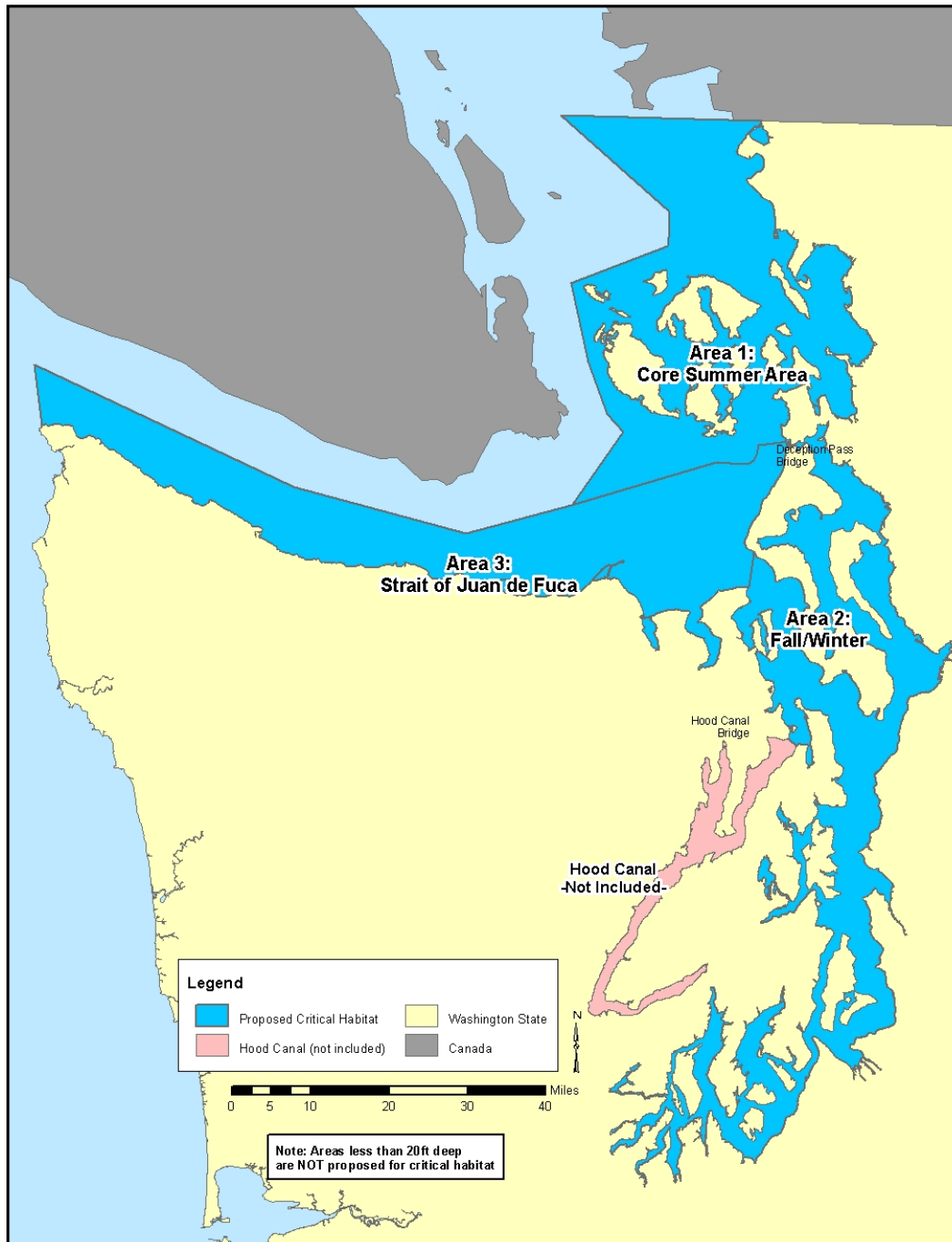


Exhibit ES-2 summarizes key findings of the analysis.

Exhibit ES-2	
KEY FINDINGS	
<ul style="list-style-type: none"><li>• This analysis estimates impacts to commercial and recreational fisheries as the activity most likely to be impacted by critical habitat designation for the killer whales.</li><li>• The estimates presented in this analysis capture a broad range of impacts as many of the conservation efforts to be pursued for the benefit of the whales through section 7 of the Endangered Species Act are, as yet, uncertain. Thus this analysis endeavors to bound potential impacts within reasonable ranges.</li><li>• Economic impacts on commercial and recreational fishing will vary depending on the management scenario.<ul style="list-style-type: none"><li>▪ Reducing overall salmon catch within potential critical habitat may result in an annual impact to commercial and recreational fisheries from \$1.0 million for a 5 percent reduction in catch to \$10.1 million for a 50 percent reduction in catch (applying either a three or seven percent discount rate).*</li><li>▪ Closing various Catch Areas to fishing results in variable impacts to commercial and recreational fisheries. Closure of the Catch Area 4 is expected to generate the least annual impact, \$29,000, whereas closure of Catch Area 5 may result in annual impacts up to \$6.1 million (applying either a three or seven percent discount rate).</li></ul></li><li>• This analysis also considers potential impacts of critical habitat on water quality management activities qualitatively in Section 3. Absent specific information on water quality thresholds that are considered protective of killer whales and habitat, impacts to these activities are not quantified.</li><li>• Economic impacts are expected to be greatest in potential critical habitat Area 2.</li></ul>	
* Because these impacts are estimated as non-capital, annual harvest impacts, their magnitudes are independent of discount rate.	

### **Framework for the Analysis**

Section 4(b)(2) of the ESA requires NOAA Fisheries to designate critical habitat on the basis of the best scientific data available, after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat. NOAA Fisheries may exclude areas from critical habitat designation when the benefits of exclusion outweigh the benefits of including the areas within critical habitat, provided the exclusion will not result in extinction of the species.<sup>2</sup>

Section 7 of the ESA requires Federal agencies to consult with NOAA Fisheries to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. The administrative costs of these consultations, along with the costs of project modifications resulting from these consultations, represent direct compliance costs associated with listing the species and designating critical habitat.

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<sup>2</sup> 16 U.S.C. §1533(b)(2).

This analysis discusses the scope and scale of two types economic activities that may affect whales or habitat across the potential designation, as well as the impact of potential regulatory scenarios that NOAA Fisheries may recommend through section 7 consultation to minimize and mitigate the effect of these activities on the whales and their habitat. Commercial and recreational fisheries and water quality management activities are identified as most likely to be affected by the potential critical habitat designation and are contemplated in this economic analysis.

## **Results of the Analysis**

### **Fisheries**

Puget Sound has active commercial fisheries for salmon, groundfish, coastal pelagic species, highly migratory species, and shellfish, as well as recreational fisheries for salmon, sturgeon, and other marine fish. Area 2 of potential critical habitat, the Fall/Winter Area, had the largest catch in 2003, contributing 66 percent of all catch in Puget Sound. The Core Summer Area (Area 1), contributed 36 percent to the overall catch, while the Strait of Juan de Fuca (Area 3), contributed only 6 percent. Overall, commercial catch represented 90 percent of catch (by number of fish landed) in Puget Sound in 2003.

Because these fisheries, particularly the salmon fishery as salmon is the main component of the whales' diet, compete with killer whales for fish, NOAA Fisheries may choose to alter fishery management to increase prey availability for killer whales after critical habitat is designated. A specific level of allowable fishing activity that would increase prey availability for the killer whales has not been identified, nor is it certain that such an impact will occur, even under section 7 of the ESA.

The biological knowledge of killer whale feeding habits and requirements is currently insufficient to explicitly model changes in the salmon fishery that would benefit the whales. This analysis therefore analyzes two hypothetical regulatory scenarios to provide context for understanding potential economic impacts that could result from changes in fisheries for the benefit of the whales. The three scenarios analyzed are summarized below; results across potential critical habitat are highlighted in Exhibit ES-3.

- Scenario 1 values incremental reductions to overall salmon catch across Puget Sound, using years 2000 to 2004 annual salmon catch as the baseline for measuring change. Reductions in catch are assumed to be borne evenly across fisheries and critical habitat areas. Under this scenario, total net economic value of salmon catch lost annually varies from \$1.0 million for a 5 percent reduction in catch to \$10.1 million for a 50 percent reduction in catch.
- Scenario 2 examines annual economic impacts resulting from closures of particular Catch Areas. Overall, Catch Area closures could range in lost net economic value from \$29,000 (Catch Area 4B), to \$6.1 million in Catch Area 5.



These scenarios apply several strong simplifying assumptions to estimate potential impacts of changes to fisheries absent data regarding the likely management strategy that NOAA will recommend for killer whale conservation. These assumptions include no substitution or adaptation by fishermen when partial area closures or overall catch reductions in the potential critical habitat area are imposed. In fact, some adaptation is likely to occur on the part of private as well as Tribal entities. In addition, the analysis relies on recent catch data rather than fishery models as the models require compounded assumptions to generate impact estimates. With these limitations in mind, the analysis attempts to provide estimates that will help understand the order of magnitude of potential impacts should these management strategies be undertaken. More detailed economic modeling is recommended once a detailed set of management strategies are designed.

<b>Exhibit ES-3</b>				
<b>SUMMARY OF POTENTIAL ANNUAL IMPACTS TO FISHERIES ASSOCIATED WITH CRITICAL HABITAT DESIGNATION FOR THE WHALES</b>				
<i>Scenario 1</i>				
<b>Percent Reduction in Salmon Catch</b>	<b>Annual Economic Impacts Across Potential Critical Habitat*</b>			
	<b>Area 1</b>	<b>Area 2</b>	<b>Area 3</b>	<b>Total Habitat</b>
5 Percent	\$305,000	\$466,000	\$236,000	\$1,007,000
10 Percent	\$611,000	\$932,000	\$471,000	\$2,014,000
20 Percent	\$1,222,000	\$1,864,000	\$943,000	\$4,029,000
30 Percent	\$1,833,000	\$2,796,000	\$1,414,000	\$6,043,000
40 Percent	\$2,444,000	\$3,728,000	\$1,885,000	\$8,057,000
50 Percent	\$3,055,000	\$4,660,000	\$2,357,000	\$10,071,000
<i>Scenario 2</i>				
<b>Assumption of Catch Area Closed</b>	<b>Annual Economic Impacts Across Potential Critical Habitat*</b>			
	<b>Area 1</b>	<b>Area 2</b>	<b>Area 3</b>	<b>Total Habitat</b>
Catch Area 4	\$0	\$0	\$29,000	\$29,000
Catch Area 5	\$0	\$0	\$6,104,000	\$6,104,000
Catch Area 6	\$0	\$0	\$524,000	\$524,000
Catch Area 7	\$6,110,000	\$0	\$0	\$6,110,000
Catch Area 8	\$0	\$3,697,000	\$0	\$3,697,000
Catch Area 9	\$0	\$120,000	\$0	\$120,000
Catch Area 10	\$0	\$2,629,000	\$0	\$2,629,000
Catch Area 11	\$0	\$1,973,000	\$0	\$1,973,000
Catch Area 13	\$0	\$900,000	\$0	\$900,000
Note: Totals may not sum due to rounding.				
* Impacts as estimated are independent of discount rates as they are non-capital, annual harvest impacts.				

## Water Quality

Activities in Puget Sound that may affect killer whales by compromising water quality include oil spills, disposal of chemical compounds in industry, agriculture, households, urban runoff, atmospheric deposition, leachate from landfills, effluent from wastewater treatment plants, and other water pollution activities. Compromised water quality can affect killer whales through reduction of prey population, bioaccumulation of contaminants in prey, and direct health effects.

Estimating impacts of modifications to water quality management is difficult, as it is unclear what contaminant thresholds NOAA Fisheries may request in consideration of the whales. The issue is further complicated by the ambiguity of the necessary geographic scope of any potential modifications. Contaminant sites throughout the entire watershed, as well as through atmospheric deposition, may affect the water quality within the potential critical habitat area. Thus, the analysis identifies and locates existing point source contamination areas and locations of recent oil spills in relation to potential critical habitat. Specific estimates of likely or potential impacts on water quality, however, are not quantified.

As mandated by the Clean Water Act, the State of Washington identifies waters to designate as section 303(d) impaired waters. EPA reviews and approves lists of impaired waters and specific Total Maximum Daily Loads (TMDLs) of contaminants. NOAA Fisheries states that the three elements that are considered to be of greatest concern to cetaceans are mercury, cadmium, and lead. In addition, PCBs, polycyclic aromatic hydrocarbons, pesticides, dioxins, and furans are a concern. Overall, 192 waters in the Puget Sound watershed are on the Section 303(d) list. Of these, 91 fall less than one mile from potential critical habitat.

Under the National Pollutant Discharge Elimination System (NPDES) program, EPA sets pollutant-specific limits on the point source discharges for major industries and provides permits to individual point sources that apply to these limits. The analysis estimates that 302 NPDES permitted facilities exist less than one mile from potential critical habitat.

In addition to 303(d) listed waters and NPDES permitted facilities, this analysis considers projects permitted by Washington Department of Ecology (WDOE) and the DOT, including sewage discharges, Superfund sites, and stormwater outfalls. Approximately 713 WDOE permitted facilities and 629 DOT-tracked highway stormwater outfalls exist within one mile of potential critical habitat.

For section 303(d) listed waters, NPDES permitted facilities, and WDOE and DOT permitted projects, volumes are greatest in the Fall/Winter Area (Area 2).

Disposal of dredge material in open water may also compromise water quality. Disposal of contaminated sediment is typically already required to occur at an upland site.<sup>3</sup> Alternative disposal methods for contaminated dredge material are therefore considered baseline protections in this analysis. In the case that clean dredge material is slated for open-water disposal in whale

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<sup>3</sup> Rivers and Harbors Act (RHA), Section 10 (33 U.S.C. 403); Written communication, Doug Hotchkiss, Project Manager, Port of Seattle, September 19, 2005.

habitat during whale season, NOAA Fisheries may request alternative disposal sites, such as upland sites. NOAA Fisheries considers the potential affect of disposal of dredge material on the whales to be solely covered by jeopardy, however, because the danger is physical harm to the whales, not modification of their habitat. Alternative methods of disposal of dredge material is therefore not considered to be a co-extensive impact, and is instead treated as part of the baseline stemming from the listing (jeopardy alone) of the whales.<sup>4</sup>

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<sup>4</sup> Personal communication with NOAA Fisheries, May 23, 2006.

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## SECTION 1

## OVERVIEW OF SPECIES AND HABITAT

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### 1.1 Overview of Southern Resident Killer Whale Status and Habitat

The southern resident killer whales (whales) comprise three subpopulations or "pods:" J pod, K pod, and L pod. On May 29, 2003, NOAA Fisheries classified the whales' stock as "depleted" under the Marine Mammal Protection Act (MMPA).<sup>5</sup> On November 18, 2005, NOAA Fisheries listed the whales as threatened under the Endangered Species Act (ESA). The proposed listing rule (PR) did not formally propose critical habitat for the distinct population, but did solicit comment on issues pertaining to the listing, including data to support critical habitat designation.<sup>6</sup>

The whales' spring, summer, and fall range includes three areas: the inland waterways of Puget Sound, the Strait of Juan de Fuca, and the Southern Georgia Strait. The winter range of the population is not well understood. The specific areas being considered for critical habitat by NOAA Fisheries are classified as follows and highlighted in Exhibit 1-1:

- **Area 1: Core Summer Area-** This area include the Georgia Strait from the Canadian Border south to Deception Pass Bridge.
- **Area 2: Fall/Winter Area-** This includes the inland waterways of Puget Sound south of Deception Pass Bridge, excluding Hood Canal.
- **Area 3: Strait of Juan de Fuca-** This area includes the U.S. waters of the Strait.

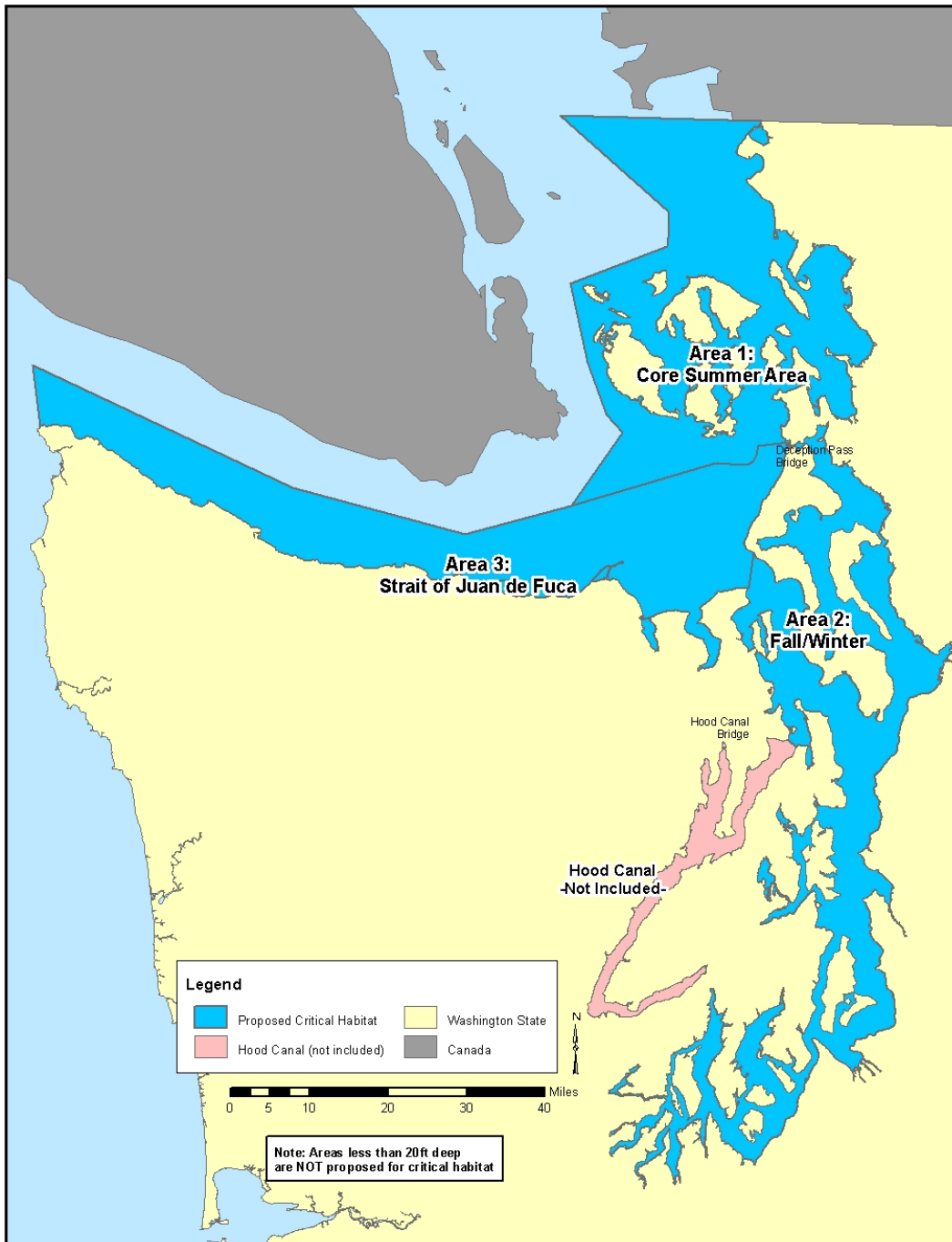
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<sup>5</sup> Department of Commerce, National Oceanic and Atmospheric Administration, Regulations Governing the Taking and Importing of Marine Mammals; Eastern North Pacific Southern Resident Killer Whales, 68 FR 31980-31983.

<sup>6</sup> Department of Commerce, National Oceanic and Atmospheric Administration, Endangered and Threatened Wildlife and Plants: Proposed Threatened Status for Southern Resident Killer Whales, 69 FR 76673-76682.

Exhibit 1-1

POTENTIAL CRITICAL HABITAT FOR SOUTHERN RESIDENT KILLER WHALES



Source: NOAA Fisheries, August 17, 2005.

NOAA Fisheries identifies the following physical or biological features (primary constituent elements) of the whales' habitat:

- 1) Water quality to support growth and development;
- 2) Prey species of sufficient quantity, quality, and availability to support growth, reproduction, and development, as well as overall population growth; and
- 3) Passage conditions to allow for migration, resting, and foraging.

## **1.2 Analytical Approach**

### **Objective of the Analysis**

Section 4(b)(2) of the ESA requires NOAA Fisheries to consider economic and other relevant impacts of designating a particular area as critical habitat. NOAA Fisheries may exclude an area from critical habitat if it determines that the benefits of such exclusion outweigh the benefits of specifying the area as critical habitat, unless it determines that the failure to designate the area will result in the extinction of the species.

The objective of the economic analysis is to identify the economic impacts of designating particular areas as critical habitat for the killer whales. Section 7 of the Act requires Federal agencies to consult with NOAA Fisheries to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. The administrative costs of these consultations, along with the costs of project modifications resulting from these consultations, represent direct compliance costs associated with listing the species and designating critical habitat. The costs of project modifications are measured using various metrics throughout this report, and are termed "economic impacts" in this analysis.

This analysis does not forecast the number and type of future consultations that may occur as a result of the listing and potential critical habitat designation for the whales, and therefore does not include potential administrative costs to the Service and stakeholder agencies of conducting these consultations. While administrative costs of consultation are real costs of section 7, uncertainty exists regarding how NOAA Fisheries will proceed with consultations regarding the activities that may affect killer whales addressed in this report. For example, impacts may be considered in one or a series of programmatic consultations that incorporate consideration of multiple listed species. Alternatively, actions may be consulted on a case by case basis. It may also be the case that a Federal agency may alter its activities so that they do not affect killer whales, and may not enter into consultation with NOAA Fisheries at all. Because of the significant uncertainty regarding how consultation activity may be undertaken, both on the part of the Action agencies and NOAA Fisheries, this analysis focuses on the costs of modifying activities as a result of section 7 consultation to describe impacts of critical habitat designation for the whales.

The economic analysis considers both the economic efficiency and distributional effects that may result from species and habitat protection. In the case of habitat conservation, economic efficiency effects generally reflect the “opportunity costs” associated with the commitment of resources required to comply with the Act. The analysis will also consider how the impacts of the designation are distributed, including an assessment of any local or regional impacts of habitat conservation and the potential effects of conservation activities on small entities. This information can be used by decision-makers to assess whether the effects of the designation might unduly burden a particular group or economic sector.

The economic analysis identifies impacts associated specifically with both listing and critical habitat designation. Where information is available to attribute an economic impact to either the listing of the species or the designation of its critical habitat, the economic analysis classifies the impacts accordingly. In the absence of such information, the economic analysis includes impacts as attributable “co-extensively” to the listing and critical habitat designation.

Executive Order 12866 also directs Federal agencies to provide an assessment of the benefits of a proposed regulatory action. However, in its guidance for implementing Executive Order 12866, the Office of Management and Budget (OMB) acknowledges that, often, it may not be feasible to monetize, or even quantify, the benefits of environmental regulations.<sup>7</sup> Where benefits cannot be quantified, OMB directs agencies to describe the benefits of a proposed regulation qualitatively. In addition, OMB guidance contemplates that “cost-effectiveness” analysis may be appropriate in certain instances, including when a full cost-benefit analysis is difficult to implement. *The net costs estimated in this economic analysis are intended to be weighed against a metric of biological benefits of designating particular areas as critical habitat as determined by NOAA Fisheries.*

## **Analytic Baseline**

Establishment of a baseline is a key step in conducting an economic analysis. Determination of the appropriate baseline for the economic analysis of critical habitat designation for the killer whale must consider existing court decisions, including considering the “full” impact of critical habitat under the *New Mexico Cattle Growers Association* case.<sup>8</sup> Thus, this analysis evaluates potential impacts of section 7 implementation for the whales under both critical habitat and the listing of the species.

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<sup>7</sup> U.S. Office of Management and Budget, “Circular A-4,” September 17, 2003.

<sup>8</sup> *New Mexico Cattle Growers Association v. United States Fish and Wildlife Service*, 248 F.3d 1277 (10th Cir. 11 May 2001). “Because economic analysis done using the FWS’s baseline model is rendered essentially without meaning by 50 C.F.R. §402.02 [the regulatory definitions], we conclude Congress intended that the FWS conduct a full analysis of all of the economic impacts of a critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes. Thus, we hold the baseline approach to economic analysis is not in accord with the language or intent of the ESA.”



*Existing* protections that are likely to benefit the killer whales, however, are included in the baseline for this analysis. The following elements are considered to be baseline protection in this analysis:

- Federal laws (Endangered Species Act, Marine Mammal Protection Act, Clean Water Act, Magnuson-Stevens Fishery Conservation and Management Act, Oil Pollution Act, National Marine Sanctuaries Act, and Coastal Zone Management);
- State laws or agreements (Washington State Shoreline Management Act of 1971); and
- Laws and regulatory actions put forward to protect Pacific salmon and steelhead, or other fisheries in Puget Sound (ESA protections afforded to listed salmon stocks under section 9 and section 7 of the Act, The United States-Canada Pacific Salmon Treaty, U.S. v Washington, the Boldt Decision (384 F. Supp. 312, U.S. District Court for the Western District of Washington, Tacoma District 1974), American Fisheries Act, Executive Order 12962: Recreational Fisheries).

## **Framework for the Analysis**

The analysis presents the economic impacts for each of the three critical habitat areas. Based on initial meetings and communications with NOAA Fisheries and relevant stakeholder agencies, and review of relevant documents, activities were identified that may affect the primary constituent elements of the whales' habitat and therefore be subject to section 7 consultation regarding the whales. The following activities were excluded from consideration:

- Activities related to national security including port security upgrades, military vessel traffic, and naval combat training exercises. These issues are covered in a separate report.
- Activities lacking a Federal nexus, including recreational boating.
- NOAA Fisheries could not identify a federal nexus for a section 7 consultation on vessel traffic that would relate to the effects of vessels on killer whale passage. The only vessels identified with a section 7 nexus were U.S. vessels, such as military, Coast Guard, etc., and ferries, which receive Federal funding. Because these vessels do not affect the whales' ability to pass freely among areas, however, NOAA Fisheries does not anticipate that section 7 consultations will have any habitat-related impacts on operations of these vessels. For this reason, the economic analysis does not include any impacts related to killer whale passage.

- Activities that NOAA Fisheries considers to exclusively affect section 9 "take" of whales are also excluded from quantitative analysis.

The remaining activities are identified as most likely to be affected by the potential critical habitat designation and are included in the economic analysis:

- 1) **Fisheries** (commercial and recreational);
- 2) **Water Quality Management** (development of water quality standards, oil spill response, disposal of dredge material, etc.).

The analysis utilizes Geographic Information Systems (GIS) and other available data to identify the geographic scope of these activities that may affect the potential critical habitat. The analysis then estimates economic impacts associated with avoidance or mitigation of these effects. It then draws on published data and agency and stakeholder expertise to identify conservation efforts that may be undertaken to avoid effects on the whales and their habitat. The analysis also considers impacts to small entities.

The quantified economic impacts to commercial and recreational fisheries are estimated as non-capital, annual harvest impacts. Their magnitude is independent of discount rate and the choice of a discount rate therefore does not affect the annualized cost estimate.

### 1.3 **Demographic Data**

The twelve counties that border Puget Sound and may be affected by killer whale critical habitat represent a range of urban and rural environments. King County, which includes the City of Seattle, is the most populous county of the twelve with a population of about 1.7 million in 2000, representing about 29.5 percent of the population of Washington State. Pierce County, including the city of Tacoma, has the second largest population of the twelve counties, about 700,000 in 2000. Pierce County contained 11.9 percent of Washington's population. San Juan County has the smallest population of the twelve counties with about 14,000 people in 2000 (0.2 percent of the State's population). Together, the 12 counties in the study area accounted for 67 percent of Washington state's population in 2000.

The populations in all counties surrounding Puget Sound have been growing. Between 1990 and 2000, the largest growth has been in San Juan County where population increased more than 40 percent. Snohomish, Whatcom and Skagit County showed the next largest growth with about 30 percent growth in each county between 1990 and 2000.

**Exhibit 1-2**

**SOCIOECONOMIC PROFILE OF COUNTIES BORDERING POTENTIAL CRITICAL HABITAT  
FOR THE KILLER WHALE**

<b>County</b>	<b>Population Density (persons/ sq mi)</b>	<b>Population (2000)</b>	<b>% of Statewide Population</b>	<b>% Change (1990-2000)</b>	<b>Per Capita Income (1999)</b>	<b>Poverty Rate (1999)</b>
<b>State Total</b>	<b>88.6</b>	<b>5,894,121</b>	<b>100.0%</b>	<b>21.1%</b>	<b>\$22,973</b>	<b>10.60%</b>
Clallam	37.1	64,525	1.1%	14.8%	\$19,517	12.50%
Island	343.3	71,558	1.2%	18.9%	\$21,472	7.00%
Jefferson	14.3	25,953	0.4%	27.2%	\$22,211	11.30%
King	817	1,737,034	29.5%	15.2%	\$29,521	8.40%
Kitsap	585.8	231,969	3.9%	22.3%	\$22,317	8.80%
Mason	51.4	49,405	0.8%	28.9%	\$18,056	12.20%
Pierce	417.4	700,820	11.9%	19.6%	\$20,948	10.50%
San Juan	80.5	14,077	0.2%	40.3%	\$30,603	9.20%
Snohomish	290.1	606,024	10.3%	30.2%	\$23,417	6.90%
Skagit	59.3	102,979	1.7%	29.5%	\$21,256	11.10%
Thurston	285.2	207,355	3.5%	28.6%	\$22,415	8.80%
Whatcom	78.7	166,814	2.8%	30.5%	\$20,025	14.20%

Source: U.S. Census Bureau, Census 2000 and State County QuickFacts, accessed at <http://quickfacts.census.gov/qfd>.

Median per capita income in nine of the twelve counties is lower than median per capita income for the entire state. The poverty rate in five of the twelve counties exceeds the statewide poverty rate of 10.6 percent. In Whatcom County the poverty rate is the highest among the twelve counties with 14.2 percent of residents below the poverty threshold.

The counties bordering potential critical habitat for the whales represent slightly more than 67 percent of Washington's total population. Half of these counties are more densely populated compared to the statewide population density of 89 persons per square mile. The populations of seven of the twelve counties expanded by more than 25 percent between 1990 and 2000. In short, the counties bordering potential critical habitat for the whales range from rural, lightly populated counties with as few as 14 persons per square mile to urban, heavily populated counties with as many as 586 persons per square mile. The spectrum of economic welfare across the twelve counties is equally diverse encompassing counties with median per capita income under \$20,000 to San Juan County with per capita income over \$30,000.

## Economic Activity

Examining the composition of economic activity within the affected counties provides some insight into which industries critical habitat for the whales are most likely to affect. Appendix A, Exhibit A-1 presents Washington industries disaggregated according to annual payroll size. Summed across all counties the industries with the largest payrolls in order of size are the service, manufacturing, information, retail, and finance and insurance industries.<sup>9</sup> Appendix A, Exhibit A-2 shows Washington industries disaggregated according to number of establishments and employees. The U.S. Census Bureau defines establishments as physical locations at which business activities are regularly conducted with one or more paid employees. The largest employer across the twelve counties is the service industry followed by the retail, manufacturing, and construction industries. In total, approximately 118,284 establishments employ 1,712,904 individuals across the twelve counties bordering potential critical habitat for the whales.

In 1993, business establishments classified as water dependent employed seven percent of the total workforce and represented six percent of total business establishments in the twelve counties along potential critical habitat for the whales. An industry is considered water dependent if it cannot conduct business away from water. In other words, a shoreline location with heavy tourist traffic might enhance a restaurant business; however, restaurants can thrive away from shorelines. By contrast, a boat rental company cannot do business anywhere but along a shoreline. Thus the boat rental company, but not the restaurant, would be considered a water dependent establishment. Water dependent industries in the twelve counties bordering potential critical habitat for the whales include aquaculture, particularly clam, oyster, and mussel cultivation, recreational and commercial fishing, boating equipment and services, lumber and wood processing, and shipping.<sup>10</sup>

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<sup>9</sup> Miscellaneous services includes professional, scientific, and technical services; management of companies and enterprises; administration, support, waste management, and remediation services; educational services; health care and social assistance; arts, entertainment, and recreation; accommodation and food services; and other services, excluding public administration.

<sup>10</sup> Sommers, Paul and Diana Canzoneri, 1996. *The Sound Economy: Puget Sound Region's Industries and their Relationship to the Sound*. Report for People for Puget Sound, August 1996.

## 2.1 Overview

The biological knowledge of killer whale feeding habits and requirements is currently insufficient to explicitly model changes in the salmon fishery that would benefit the whales. This section therefore analyzes two hypothetical regulatory scenarios to provide context for understanding potential economic impacts that could result from changes in fisheries management for the benefit of the whales. This analysis uses the average catch, and value of that catch, from years 2000 to 2004 as the baseline for the estimation of these impacts.

- Scenario 1 values incremental reductions to overall salmon catch across Puget Sound. Reductions in catch are assumed to be borne evenly across fisheries and critical habitat areas. Under this scenario, total net economic value of salmon catch lost annually varies from \$1.0 million for a 5 percent reduction in catch to \$10.1 million for a 50 percent reduction in catch.
- Scenario 2 examines annual economic impacts resulting from closures of particular Catch Areas. Overall, Catch Area closures could range in lost net economic value from \$29,000 (Catch Area 4B), to \$6.1 million in Catch Area 5.

These scenarios use several strong simplifying assumptions to estimate potential impacts of changes to fisheries absent data regarding the likely management strategy that NOAA will recommend for killer whale conservation. These assumptions include assuming there will be no substitution or adaptation by fishermen when partial area closures or overall catch reductions in the potential critical habitat area are imposed. In fact, some adaptation is likely to occur on the part of private as well as Tribal entities. In addition, the analysis relies on recent catch data rather than fishery models, because these would have required compounded assumptions to generate impact estimates. With these limitations in mind, the analysis attempts to provide estimates that will help understand the order of magnitude of potential impacts, should these management strategies be undertaken. More detailed economic modeling is recommended once a detailed set of management strategies are designed.

## 2.2 Background

Research has found that resident whales congregate in coastal locations at times associated with high densities of migrating salmon. For example, "the population's annual presence in the vicinity of the San Juan Islands and Fraser River mouth from late spring to early fall suggests a dependence on salmon returning to this river system."<sup>11</sup> Diet studies of killer whales in British Columbia and Washington State suggests that nearly all (97 percent) of prey for killer whales are salmonid species.<sup>12</sup> During May through August, a large percentage (80 percent) of prey is estimated to be chinook salmon, while chum salmon is the dominant prey in September and October, at least in northern resident killer whales.<sup>13</sup>

Many stocks of salmon have declined in Puget Sound in recent years, and two stocks currently are listed as threatened or endangered under the ESA (Puget Sound Chinook ESU and Hood Canal summer chum ESU). It is unknown whether current food scarcity is contributing to increased killer whale mortality, though concerns exist about whether reduced quantity or quality of prey affects the health of the Southern Resident population.<sup>14</sup> Biologists hypothesize that "reductions in prey availability may force whales to spend more time foraging and might lead to reduced reproductive rates and higher mortality rates."<sup>15</sup> However, biologists' understanding of biology is hampered by several factors:

Status assessments of the food sources available to killer whales in the region are complicated by numerous considerations, including a lack of detailed knowledge on the food habits and seasonal ranges of the whales, uncertainties in the historical and current abundance levels of many localized populations of prey, and the cyclic nature of large-scale changes in ocean conditions.<sup>16</sup>

Biologists in the State of Washington conclude that, "without better knowledge of selected salmon runs, the effects on resident killer whales of changing salmon abundance in key runs cannot be judged. In former times, the whales may have simply moved to other areas with adequate food or shifted their diets to alternate fish stocks in response to the reduction of a

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<sup>11</sup> Wiles, Gary J. "Washington State Status Report for the Killer whale." Washington Department of Fish and Wildlife, Wildlife Program, March 2004.

<sup>12</sup> Ford, John K.B. and Graeme M. Ellis. 2005. "Prey selection and food sharing by fish-eating 'resident' killer whales (*Orcinus orca*) in British Columbia." Fisheries and Oceans Canada, Research Document 2005/041; NOAA Fisheries, "Proposed Conservation Plan for Southern Resident Killer Whales (*Orcinus orca*), October 2005.

<sup>13</sup> Ibid. Note that while the body of research on southern residents is growing, it is currently primarily based on the work of one group in British Columbia. Local experts note that feeding habitats of northern residents may be quite different than southern residents. Personal communication with Doug Melwood, Washington Department of Fish and Wildlife, September 30, 2005.

<sup>14</sup> "Endangered and Threatened Wildlife and Plants: Proposed Threatened Status for Southern Resident Killer Whales," 69 FR 245, December 22, 2004.

<sup>15</sup> Wiles, Gary J. "Washington State Status Report for the Killer whale." Washington Department of Fish and Wildlife, Wildlife Program, March 2004.

<sup>16</sup> Ibid.

heavily used run. These options may be less viable now due to broader declines of various fish populations in the region."<sup>17</sup>

Puget Sound has active commercial fisheries for salmon, groundfish, coastal pelagic species, highly migratory species, and shellfish, as well as recreational fisheries for salmon, sturgeon, and other marine fish. Because these fisheries compete with killer whales for fish, NOAA Fisheries may choose to alter fishery management to increase prey availability for killer whales after critical habitat is designated. As noted below, however, a level of allowable fishing activity that would increase prey availability for the killer whales has not been identified, nor is it certain that such an action will be taken under section 7 of the ESA. This section presents a discussion of the regulatory environment for these fisheries, a background on the fishing industry in Puget Sound, and a summary valuation of the fish that may be consumed by future killer whale stocks.

## **2.3 Regulatory Environment**

The State of Washington is responsible for managing fisheries within three miles of its shoreline. The Pacific Fishery Management Council (Council), one of eight regional fishery management councils established by the Magnuson-Stevens Fishery Conservation and Management Act, manages fisheries in the Exclusive Economic Zone (EEZ), which is the area between three and 200 miles offshore of the U.S. coastline.

The Council's fisheries management process is based on fishery management plans (FMPs) that contain a set of management objectives and strategies for implementing them. The Council currently has FMPs for salmon, groundfish, coastal pelagic species, and highly migratory species. Annual fishery plans are developed under FMPs to meet year-specific circumstances related to the status of the stocks affected by the fisheries. NOAA Fisheries reviews and approves these annual fishery plans and has also conducted an EIS on methods for implementing fishery management as part of the annual planning process.<sup>18</sup>

Three primary fisheries management considerations include the Pacific Salmon Treaty, the Puget Sound Management Plan of 1985, and the ongoing court proceedings of United States v. Washington.<sup>19</sup> The Pacific Salmon Treaty of 1985 between Canada and the United States established a framework for managing salmon stocks that cross borders, and committed the co-managers to equitable cross-border sharing of harvest as well as conservation of United States and Canadian stocks. The focus of the Treaty and subsequent Annexes is to constrain harvest on both sides in order to rebuild depressed salmon stocks.<sup>20</sup>

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<sup>17</sup> Ibid.

<sup>18</sup> "Final Programmatic Environmental Impact Statement for Pacific Salmon Fisheries Management off the Coasts of Southeast Alaska, Washington, Oregon, and California, and in the Columbia River Basin," National Marine Fisheries Service, Northwest Region, and Alaska Department of Fish and Game, November 2003.

<sup>19</sup> *United States v. Washington*, 759 f.2d 1353m 1360 (9th Cir)(en banc), cert. Denied, 474 U.S. 994 (1985).

<sup>20</sup> Puget Sound Chinook Harvest, Resource Management Plan NEPA and EIS, Section 1 (p. 25), December 2004.

The Puget Sound Management Plan of 1985 remains the guiding framework for jointly-agreed upon salmon management objectives, allocation of harvest, information exchange among the co-managers, and processes for negotiating annual harvest regimes. Fisheries operating in the Sound have been divided into those operated by Native Americans, termed “treaty fisheries,” and all others, termed “non-treaty fisheries.” United States v. Washington is a Federal court case that forms the basis for enforcement and implementation of reserved Tribal treaty fishing rights for salmon and steelhead in Western Washington.

## **2.4 Scope and Scale of Activity: Commercial and Recreational Fishing**

The Puget Sound commercial fishing industry includes businesses that harvest, distribute, and process finfish and shellfish products, as well as those that provide supplies and services to them.<sup>21</sup> Approximately 3,500 fishing vessels and 414 floating processors landed at ports in Puget Sound in 2004, of which 30 percent landed in Whatcom County. Ex-vessel revenue for fisheries were largest in Whatcom County and Mason Counties, which together represent nearly 50 percent of the ex-vessel revenue received in Puget Sound Counties.<sup>22</sup> Bellingham Bay (Whatcom County), Lower Hood Canal (Mason County), and Samish Bay (Skagit County) ports recorded the largest Chinook poundage landed in 2002, representing sixty percent of all Puget Sound chinook landed.<sup>23</sup> Exhibit 2-1 presents the 2004 commercial salmon landings in pounds by county, for all counties in the study area.

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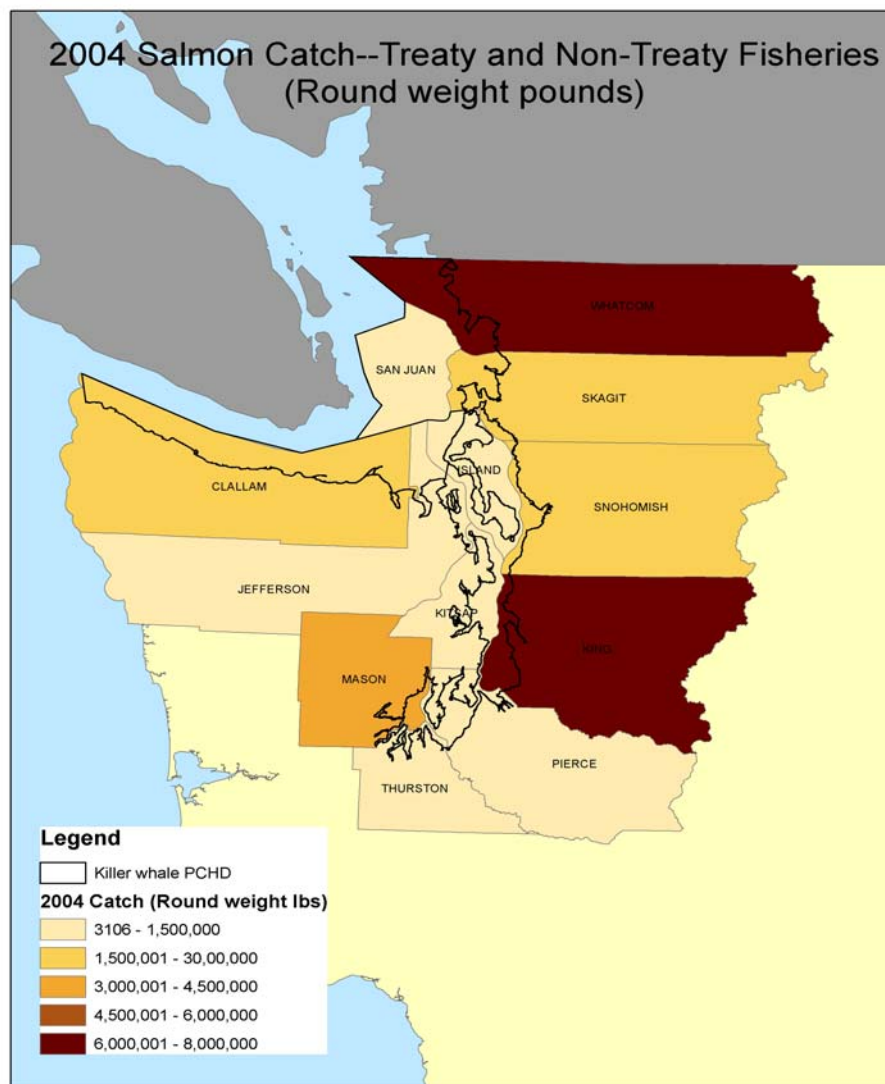
<sup>21</sup> Radtke, Hans D. and Shannon W. Davis. February 2000. Description Of The U.S. West Coast Commercial Fishing Fleet And Seafood Processors, Prepared for the Pacific States Marine Fisheries Commission.

<sup>22</sup> Pacific Fisheries Information Network (PacFIN), "Total catch for all species," 2005, accessed at <http://www.psmfc.org/pacfin/data/rcty.woc04> on August 12, 2005.

<sup>23</sup> The Research Group, "Economic Analysis Results for the Puget Sound Chinook Salmon Fishery Management Plan," Memorandum to Tom Wagge, September 18, 2003.



Exhibit 2-1

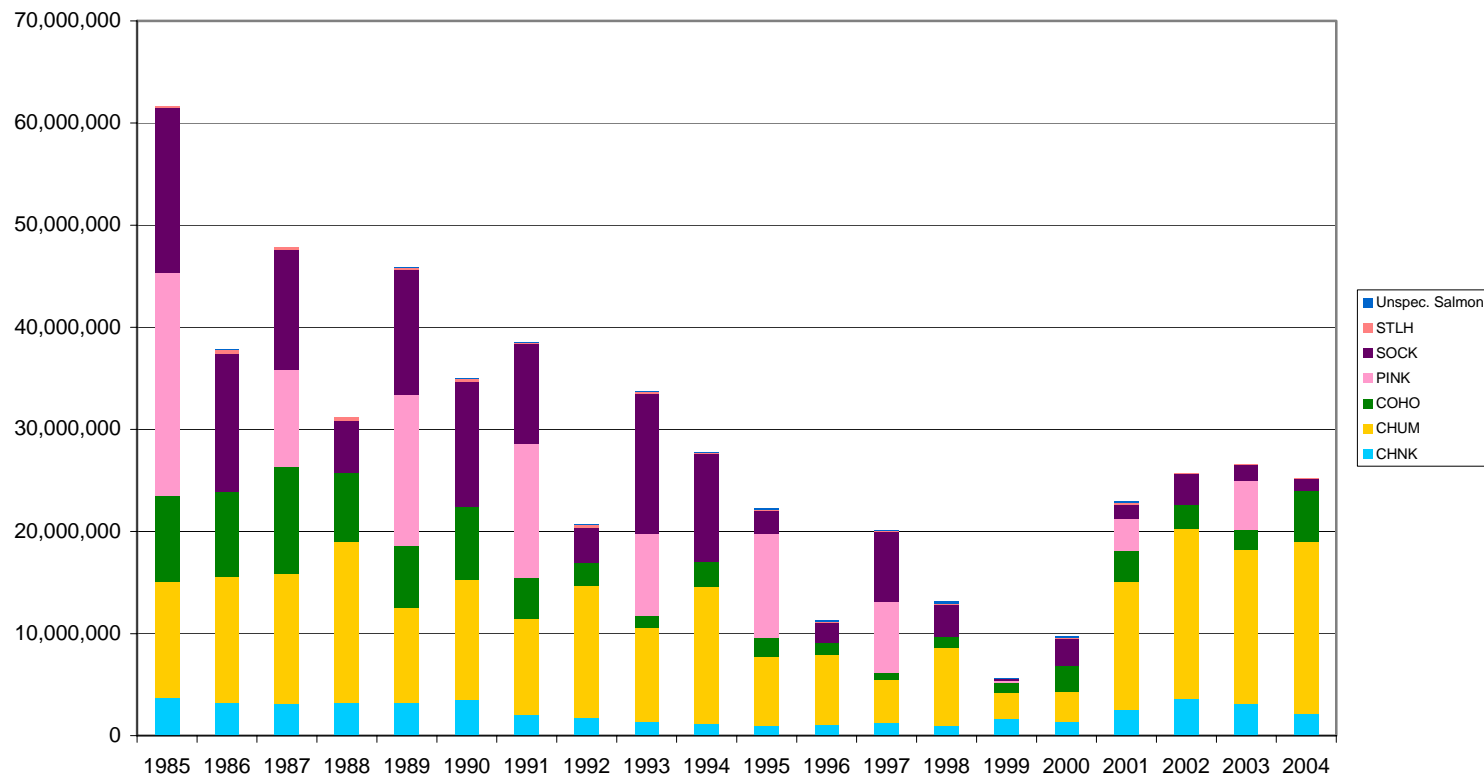


Source: Pacific Fisheries Information Network (PacFIN), "Total catch for all species," 2005.  
Accessed at <http://www.psmfc.org/pacfin/data/rcty.woc04> on August 12, 2005.

From 1985 to 2004, overall salmon catch as measured by pounds landed declined by 60 percent in Puget Sound. Exhibit 2-2 presents the commercial landed salmon catch in Puget Sound marine fisheries from 1985 through 2004, by species group. As shown, sockeye, pink, and coho landings fell most sharply, declining by 90, 80, and 75 percent, respectively, between 1985 and 2003. In contrast, chum landings increased by over thirty percent during this time period. As a result, chum made up nearly 70 percent of all pounds of salmon landed in Puget Sound in 2004, compared with 20 percent in 1985. Also clear from this exhibit is the significant decline in landings that occurred in 1999 and 2000.

Exhibit 2-2

**COMMERCIAL SALMON LANDINGS IN PUGET SOUND COUNTIES, 1985-2004  
LAND WEIGHT (POUNDS)**



Source: Pacific Fisheries Information Network (PacFIN), "Total catch for all species," 2005. Accessed at <http://www.psmfc.org/pacfin/data/rcty.woc04> on August 12, 2005. "Unspec salmon"=Salmon unspecified in catch records; "STLH"=Steelhead; "SOCK"=Sockeye; "PINK"=Pink salmon; "COHO"=Coho salmon; "CHUM"= Chum salmon; "CHNK"=Chinook salmon.

Sportfishing for salmon, sturgeon, and other marine fish is a popular activity in Puget Sound. The Washington Department of Fish and Wildlife requires permits for sportfishing, and keeps records of fish caught in freshwater areas and across 13 designated Marine Catch Areas. In 2001, the State estimated that there were 618,274 fishing trips for salmon made in marine areas of Puget Sound, with a catch of 357,558 salmon, representing 34 percent of total salmon sport catch in Washington State. Of salmon caught, 54 percent were coho, 32 percent were pink, 11 percent were chinook, while the remaining were chum and sockeye.<sup>11</sup> The number of overall fish caught recreationally in Puget Sound declined between 1990 and 2003, as did the catch of salmon species. The highest numbers of salmon caught for sport were reported in Island, Snohomish, King, and Clallam counties during this time period. A third of all sport catch was reported in Catch Area 5 (off of the Clallam County Coast) between 1990 and 2001, while Catch Areas 8, 9, and 10 (Southern Puget Sound) each had 10 percent of total catch reported.<sup>12</sup>

Exhibit 2-3 presents data on the total commercial and sportfish catch for all salmon species in Puget Sound (including treaty and non-treaty fisheries) in 2003. Critical habitat Area 2, the Fall/Winter Area, had the largest catch, contributing 66 percent of all catch in Puget Sound. The Core Summer Area (Area 1), contributed 36 percent to the overall catch, while the Strait of Juan de Fuca (Area 3), contributed 6 percent. It is worth noting that the pink salmon fishery is only open in every other year. The existence of the pink salmon fishery in a particular year seems to exaggerate trends that also occur in off years. For example, in 2002, Catch Areas 7 and 8 contributed over 20 percent of Puget Sound Catch, compared with over 50 percent in 2003.

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<sup>11</sup> Terry Manning and Sheila Smith, Washington State Department of Fish and Wildlife's 2001 Sport Catch Report, May 2005.

<sup>12</sup> Pacific States Marine Fisheries Commission Recreational Fisheries Information Network, accessed at <http://www.psmfc.org/recfin/> August 22, 2005; Terry Manning and Sheila Smith, Washington State Department of Fish and Wildlife's 2001 Sport Catch Report, May 2005.

<b>Exhibit 2-3</b> <b>COMMERCIAL AND SPORTFISH CATCH FOR ALL SALMON SPECIES</b> <b>IN PUGET SOUND, INCLUDING TREATY AND NON-TREATY FISHERIES</b> <b>(2003 SEASON)</b> <b>(Number of Fish Landed)</b>				
<b>Critical Habitat Area</b>	<b>Catch Area(s)</b>	<b>Commercial Catch</b>	<b>Sportfish Catch</b>	<b>Total Catch</b>
<b>Area 1</b>	7*	1,216,152	12,690	1,228,842
<b>Subtotal</b>		<b>1,216,152</b>	<b>12,690</b>	<b>1,228,842</b>
<b>Area 2</b>	8	384,403	125,038	509,441
	9	5,073	44,968	50,041
	10	208,511	16,805	225,316
	11	178,960	17,852	196,812
	13	56,689	2,756	59,445
<b>Subtotal</b>		<b>833,636</b>	<b>207,419</b>	<b>1,041,055</b>
<b>Area 3</b>	4b	925	n/a	925
	5	90,588	104,617	195,205
	6	3,227	13,541	16,768
<b>Subtotal</b>		<b>94,740</b>	<b>118,158</b>	<b>212,898</b>
<i>n/a</i> <i>(Hood Canal)</i>	12	930,104	10,841	940,945
<b>Total</b>		<b>3,074,632</b>	<b>349,108</b>	<b>3,423,740</b>
Sources: Washington State Department of Fish and Wildlife Commercial Catch Data, compiled September 29, 2005; Washington State Department of Fish and Wildlife Recreational Catch Data, compiled October 5, 2005.				
* Area 7 primarily lies in Critical Habitat Area 1, but crosses into Area 3.				

As shown in Exhibit 2-4, commercial catch of salmon in Puget Sound was 2.5 million in 2004. The net fishery in Puget Sound dominates the landed catch, while very little troll fishing occurs in Puget Sound (2 percent).

<b>Exhibit 2-4</b>		
<b>2004 COMMERCIAL SALMON CATCH IN PUGET SOUND BY GEAR TYPE INCLUDING TREATY AND NON-TREATY FISHERIES (Number of Fish Landed)</b>		
<b>Gear</b>	<b>2004 Catch</b>	<b>Percent of Total</b>
Purse Seine	1,305,361	53%
Gill Net	490,346	20%
Set Net	315,571	13%
Beach Seine	269,067	11%
Troll	45,294	2%
Reef Net	23,594	1%
Other	10,195	0%
Total Catch	2,459,428	100%
Source: Washington State Department of Fish and Wildlife Commercial Catch Data, compiled September 29, 2005, salmon catch data for Catch Areas 4B-13.		

## 2.5 Impacts Estimation

The salmon fisheries of Puget Sound are managed cooperatively by the State of Washington and numerous Indian tribes, subject to the court decision *U.S. v. Washington* (626 F.Supp. 1405, 1985, W.D. Washington). These fisheries potentially affect two ESUs listed under the Endangered Species Act: Puget Sound Chinook and Hood Canal summer chum. For this reason, the harvest management plans for the Puget Sound salmon fisheries are subject to the Section 9 take prohibitions.

On July 10, 2000, NOAA Fisheries issued the ESA 4(d) Rule establishing take prohibitions for 14 salmon and steelhead ESUs, including the Puget Sound Chinook and Hood Canal summer chum salmon ESUs (50 CFR 223.203(b)(6); July 10, 2000, 65 FR 42422). The ESA 4(d) Rule provided limits on the application of the take prohibitions, i.e., take prohibitions would not apply to the plans and activities set out in the rule if those plans and activities met the rule's criteria. One of those limits (Limit 6) applies to joint tribal and state resource management plans.

On March 18, 2004, the Puget Sound Treaty Tribes (PSTT) and the Washington Department of Fish and Wildlife (WDFW) submitted a jointly developed resource management plan to NOAA Fisheries. The resource management plan, titled the "Puget Sound Comprehensive Chinook Management Plan: Harvest Management Component," dated March 1, 2004 (hereafter referred to as the RMP), provides the framework within which the tribal and state jurisdictions would jointly manage all salmon and gillnet steelhead fisheries that might impact listed chinook salmon within the greater Puget Sound area.

Because the RMP is approved by NOAA Fisheries, that approval is considered a federal action for the purposes of Section 7 of the ESA, and so NOAA Fisheries must consult with itself

to ensure that its approval of the RMP meets the requirements of that section. A potential impact of designating critical habitat for killer whales, then, is to bring the RMP under the requirement not to adversely modify areas so designated. Because salmon are important prey species for killer whales, the section 7 requirements could lead to NOAA Fisheries to consider the impacts of a salmon harvest on killer whale critical habitat.

Recent conversations with NOAA Fisheries indicate that the mechanisms by which the fishing industry could be affected by killer whales considerations are:

- 1) *Escapement goals/fishing regime for fisheries in Puget Sound altered to increase prey availability for killer whales.*
- 2) *Closures of particular areas to fishing in some seasons or all year.*

These two mechanisms could result in reductions in landings and related losses in economic value, all other factors affecting landings held constant. Developing a quantitative forecast of these impacts is difficult, however, and speculative for a number of reasons. First, salmon conservation and recovery efforts are already considerable. It is unclear whether NOAA Fisheries would, or could, attempt to develop additional recovery initiatives for salmon to benefit killer whales. In addition, the biological knowledge of killer whale feeding habits and requirements is currently insufficient to explicitly model necessary changes in the salmon fishery.

For example, to address how future changes in Puget Sound fishing regimes could affect economic activities, NOAA Fisheries would need to develop projected scenarios for specific alterations to fishery management to a point that a fishery model could provide information about the outcome of such changes. These scenarios are dependent upon certain key biological factors for each age class of each salmon stock, including:

- "pre-season" ocean abundance;
- "pre-season" ocean distribution;
- natural mortality rate;
- maturation rate (i.e. fraction of ocean abundance that will mature and migrate back to the natal stream); and
- "in-season" migration pattern (in time and space).

These salmon biological factors and killer whale feeding requirements could then be combined to form a projection of the number of additional fish the killer whales need to produce a positive impact on the whale population, or a reasonable range of that number of fish. With this information, a fisheries model could be applied to provide an understanding of the scale of changes needed to the existing industries. As stated in S.P. Cramer and Associates, "given the broad geographic distribution of chinook salmon and the large number of stocks and fisheries, the only way to consolidate all of this information is with computer simulation models. For a

given year, the objective of any model is to predict catches in all fisheries and escapements for all stocks, given a set of fishing regulations."<sup>26</sup> Available fisheries models include:

*PSC Chinook Model* is the primary chinook salmon harvest analysis tool of the Pacific Salmon Commission (PSC). The primary purpose of the model is to evaluate how effectively proposed fishing regimes satisfy the equity and conservation principals of the Pacific Salmon Treaty.<sup>27</sup> This model simulates harvest from 1979 to the future.

*FRAM* is the Fishery Regulation Assessment Model. Originated in 1988, this model is used primarily as a single season analysis tool, not as a long-term stock rebuilder. The model assists in planning Chinook and coho salmon fisheries in Puget Sound, Strait of Juan de Fuca, Cape Falcon, and Oregon.<sup>28</sup>

Absent data on these important biological factors, an economic analysis is limited in its ability to project likely economic impacts, and fisheries models have limited usefulness. The following section provides context for understanding the potential value of possible changes in Puget Sound fishing regimes in relation to the total fish catch and total fishery values in Puget Sound.

### **2.5.1 Quantification of Potential Impacts on Fisheries**

This analysis presents two scenarios in an attempt to provide NOAA Fisheries with context for understanding the economic value of existing fisheries and potential economic impacts that could result from changes in fisheries associated with potential killer whale critical habitat. Average catch over the period 2000 to 2004 is used as the baseline for estimation of these impacts.

- Scenario 1 values incremental reductions to overall salmon catch across Puget Sound. Reductions in catch are assumed to be borne evenly across fisheries and critical habitat areas.<sup>29</sup>
- Scenario 2 examines economic impacts resulting from closures of particular catch areas.

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<sup>26</sup> S.P. Cramer and Associates, "Status of Chinook Salmon and their Habitat in Puget Sound," Volume 2, Final Report, Prepared for the Coalition of Puget Sound Businesses, June 1999, Section V.

<sup>27</sup> Ibid.

<sup>28</sup> Ibid.

<sup>29</sup> The assumption that each fishery bears an equal percentage harvest reduction is strong, as it does not reflect the fact that different species of salmon account for significantly different proportions of the killer whale diet. Ford and Ellis (2005) found that chinook and chum salmon constituted over 90 percent of the diet for the salmon species eaten by the killer whales (northern and southern resident) they studied. Exactly how this variation could be reflected in a harvest reduction scenario, however, is too speculative to analyze.

## 2.5.2 Valuation of Potential Impacts

Radtke et al. estimate that fall and spring/summer run chinook can be valued at \$25.42 (2005\$) in net economic value (NEV) per commercially caught fish in Puget Sound.<sup>30</sup> In this case, the net economic value is the economic value of fishing less the value of any benefits foregone and the costs associated with fishing. Radtke estimates a lower NEV for coho caught in Puget Sound at only \$10.20 (2005\$). Radtke et al. does not calculate economic value per fish for other salmon species. This analysis estimates a per fish value for chum, pink and sockeye salmon using the following method: First, the average ex-vessel value per pound by species over a ten-year period was multiplied by the typical weight per fish to get an estimate of the ex-vessel value per fish for all salmon species. A ratio was then created between the per fish values for chum, pink and sockeye and that of chinook. This ratio was then multiplied by the Radtke value for chinook to produce the following estimated NEV per fish:

Chum:	\$4.57
Pink:	\$1.59
Sockeye:	\$10.92

The NEV measure subtracts the costs of harvest, including fuel, repairs, and labor, from gross revenues. Radtke estimates that the NEV per fall and chinook and coho caught recreationally in Puget Sound is \$51.43 per fish (assuming one fish caught per day).<sup>31</sup> This value measures people's estimated willingness to pay for the fishing experience. NOAA Fisheries biologists note that the actual recreational value for chinook and other salmon species are unlikely to be equivalent, as chinook is highly prized, while other salmon species are less desired by recreational fishermen. No data exist, however, to quantify or even document these differences. Therefore, this analysis assumes that recreational salmon catch results in the same net economic value for all salmon/steelhead species. This means that the estimates of these potential impacts are likely to be biased upward.

Exhibit 2-5 presents the average salmon catch between 2000 and 2004. Exhibit 2-6 presents the average net economic value of salmon fisheries in Puget Sound between 2000 and 2004. These estimates are used as a baseline against which to measure economic impacts to fisheries.<sup>32</sup>

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<sup>30</sup> Radtke, Hans D., Shannon W. Davis, and Rebecca L. Johnson. "Lower Snake River Juvenile Salmon Migration Feasibility Study: Anadromous Fish Economic Analysis." Prepared for Foster Wheeler Environmental Corporation and U.S. Army Corps of Engineers. October, 1999.

<sup>31</sup> Radtke, Hans D., Shannon W. Davis, and Rebecca L. Johnson. "Lower Snake River Juvenile Salmon Migration Feasibility Study: Anadromous Fish Economic Analysis." Prepared for Foster Wheeler Environmental Corporation and U.S. Army Corps of Engineers. October, 1999.

<sup>32</sup> Recreational catch estimates were not available for 2004 at the time of release of this analysis. Thus, recreation estimates for each catch area and species were projected based on recent catch trends (1994-2003).



## **SCENARIO 1**

As stated above, Scenario 1 models broad-scale reductions in salmon catch across Puget Sound in varying five percent increments. Because the Fall/Winter Area (Area 2) has the largest baseline salmon catch, this Area experiences the largest reduction in NEV regardless of the percent reduction in salmon catch each year. Under this scenario, total net economic value of salmon catch lost varies from \$1.0 million for a 5 percent reduction in catch to \$10.1 million for a 50 percent reduction in catch. Note that this approach employs the simplifying assumption that changes in total catch and total NEV are linear. This assumption is most appropriate for short-term, small-scale closures rather than permanent fishery changes, as it does not take into account business closures that may result from these changes as fishermen leave the area or the industry, particularly where the fishery closures are significant. It also assumes that NEV is constant with respect to changes in the scale of operation for each fishing boat. While these assumptions are strong, we have no data to support alternate assumptions. Finally, if Puget Sound salmon fishing is a major share of all commercial fishing in Puget Sound, reductions in its harvest levels may have impacts in markets for local, fishing-specific inputs such as ice. No data are available, however, to estimate these secondary changes in economic value. Results of potential impacts related to Scenario 1 changes are presented in Exhibit 2-7.

## **SCENARIO 2**

Scenario 2 presents potential economic impacts of individual Catch Area closures. As shown, the largest impacts would occur from closures of Catch Area 5, which would affect both commercial and recreational fisheries. Recreational catch would be hardest hit by closures of Catch Areas 5 and 8. Overall, Catch Area closures could range in lost net economic value from \$29,000 (Catch Area 4B), to \$6.1 million in Catch Area 5. Similar to the other scenarios, the cost valuation assumptions are simplistic, and thus present only an approximate estimate of net economic value losses. Results of potential impacts related to Scenario 2 changes are presented in Exhibit 2-8.

Exhibit 2-9 presents a summary of the potential economic impacts generated for each of the two scenarios.

**Exhibit 2-5**  
**BASELINE SALMON CATCH (Average 2000-2004 catch)**

	Area 1			Area 2			Area 3			Total		
	Commercial	Recreational	Total	Commercial	Recreational	Total	Commercial	Recreational	Total	Commercial	Recreational	Total
<b>Chinook</b>	31,742	4,403	36,145	5,206	24,554	29,760	9,200	3,434	12,634	46,148	32,391	78,539
<b>Chum</b>	96,450	58	96,508	36,053	1,889	37,941	4,719	11	4,730	137,222	1,958	139,180
<b>Coho</b>	66,145	3,124	69,269	54,269	70,006	124,276	16,622	47,898	64,520	137,037	121,028	258,065
<b>Pink</b>	259,890	3,221	263,111	2	67,963	67,965	11,780	23,484	35,264	271,671	94,668	366,340
<b>Sockeye</b>	293,296	37	293,332	1	33	34	38,146	9	38,155	331,442	79	331,521
<b>Steelhead</b>	4	0	4	1	0	1	111	0	111	116	0	116
<b>Total</b>	747,527	10,843	758,369	95,532	164,445	259,977	80,578	74,837	155,415	923,636	250,125	1,173,761

Source: IEC analysis of Washington Department of Fish and Wildlife Salmon Catch Data by Catch Area, provided October 10, 2005.

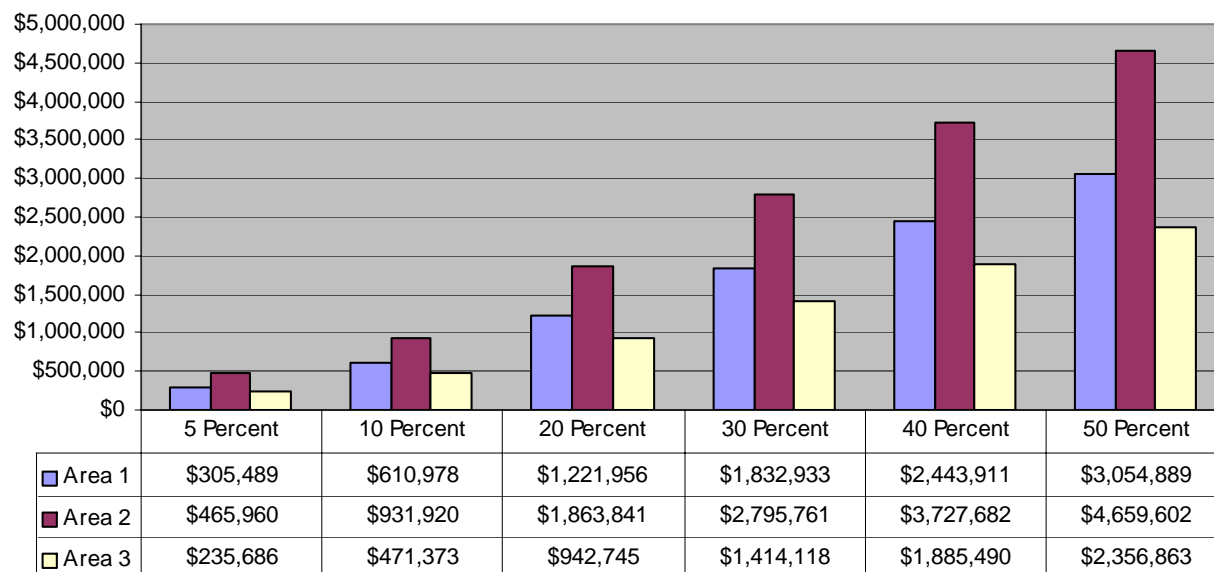
**Exhibit 2-6**  
**VALUE OF BASELINE SALMON CATCH : NET ECONOMIC VALUE**  
**(Average, 2000-2004)**

	Area 1			Area 2			Area 3			Total		
	Commercial	Recreational	Total	Commercial	Recreational	Total	Commercial	Recreational	Total	Commercial	Recreational	Total
<b>Chinook</b>	\$807,141	\$226,425	\$1,033,566	\$132,383	\$1,262,826	\$1,395,209	\$233,927	\$176,631	\$410,559	\$1,173,451	\$1,665,882	\$2,839,334
<b>Chum</b>	\$440,778	\$2,980	\$443,759	\$164,761	\$97,129	\$261,890	\$21,566	\$573	\$22,138	\$627,105	\$100,681	\$727,787
<b>Coho</b>	\$688,175	\$160,681	\$848,856	\$564,617	\$3,600,425	\$4,165,042	\$172,939	\$2,463,389	\$2,636,328	\$1,425,731	\$6,224,495	\$7,650,226
<b>Pink</b>	\$413,224	\$165,657	\$578,882	\$3	\$3,495,334	\$3,495,336	\$18,730	\$1,207,802	\$1,226,532	\$431,957	\$4,868,793	\$5,300,750
<b>Sockeye</b>	\$3,202,788	\$1,891	\$3,204,679	\$9	\$1,706	\$1,715	\$416,552	\$459	\$417,011	\$3,619,349	\$4,055	\$3,623,404
<b>Steelhead</b>	\$37	\$0	\$37	\$12	\$0	\$12	\$1,157	\$0	\$1,157	\$1,207	\$0	\$1,207
<b>Total</b>	\$5,552,144	\$557,634	\$6,109,778	\$861,785	\$8,457,419	\$9,319,204	\$864,872	\$3,848,853	\$4,713,725	\$7,278,801	\$12,863,907	\$20,142,707

Sources: IEC analysis of Washington Department of Fish and Wildlife Salmon Catch Data by Catch Area, provided October 10, 2005; Radtke, Hans D., Shannon W. Davis, and Rebecca L. Johnson. "Lower Snake River Juvenile Salmon Migration Feasibility Study: Anadromous Fish Economic Analysis." Prepared for Foster Wheeler Environmental Corporation and U.S. Army Corps of Engineers. October, 1999.

**Exhibit 2-7**

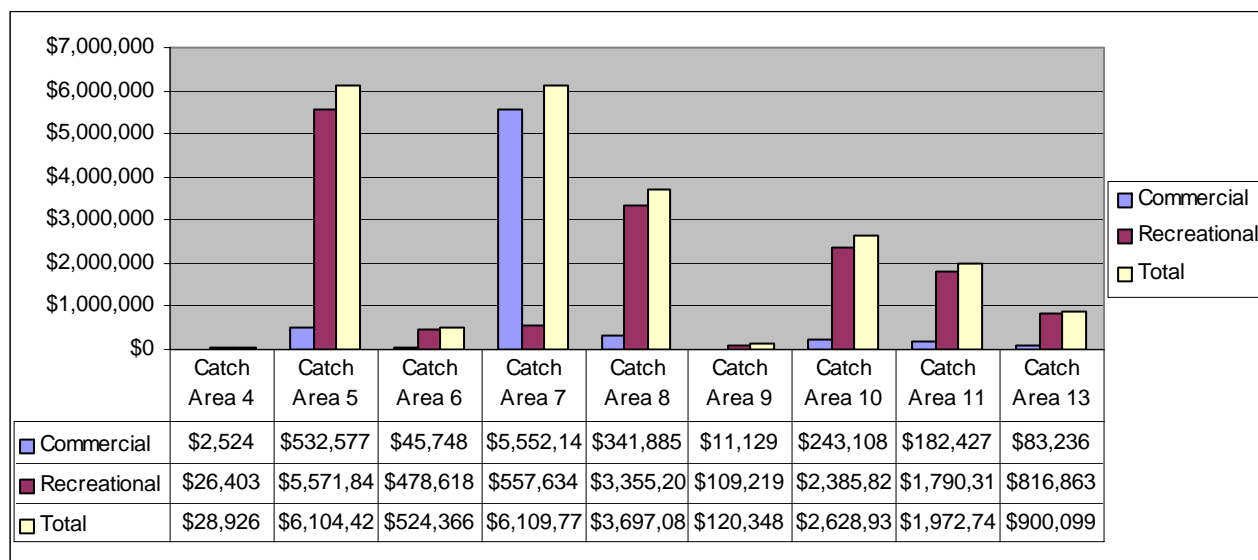
**SCENARIO 1: ANNUAL LOSS IN NET ECONOMIC VALUE OF SALMON FISHERIES RESULTING FROM AN OVERALL REDUCTION IN PUGET SOUND SALMON CATCH**



Note: This estimate uses average 2000-2004 fish catch data as the baseline. Recreational catch estimates were not available for 2004 at the time of release of this analysis. Thus, recreation estimates for each catch area and species were projected based on recent catch trends (1994-2003).

Exhibit 2-8

**SCENARIO 2: ANNUAL LOSS IN NET ECONOMIC VALUE OF SALMON FISHERIES RESULTING FROM INDIVIDUAL CATCH AREA CLOSURES**



Note: This estimate uses average 2000-2004 fish catch data as the baseline. Recreational catch estimates were not available for 2004 at the time of release of this analysis. Thus, recreation estimates for each catch area and species were projected based on recent catch trends (1994-2003).

<b>Exhibit 2-9</b>				
<b>SUMMARY OF POTENTIAL IMPACTS TO FISHERIES ASSOCIATED WITH CRITICAL HABITAT DESIGNATION FOR THE WHALES</b>				
<i>Scenario 1</i>				
<b>Percent Reduction in Salmon Catch</b>	<b>Economic Impacts Across Potential Critical Habitat (Annual)</b>			
	<b>Area 1</b>	<b>Area 2</b>	<b>Area 3</b>	<b>Total Habitat</b>
5 Percent	\$305,000	\$466,000	\$236,000	\$1,007,000
10 Percent	\$611,000	\$932,000	\$471,000	\$2,014,000
20 Percent	\$1,222,000	\$1,864,000	\$943,000	\$4,029,000
30 Percent	\$1,833,000	\$2,796,000	\$1,414,000	\$6,043,000
40 Percent	\$2,444,000	\$3,728,000	\$1,885,000	\$8,057,000
50 Percent	\$3,055,000	\$4,660,000	\$2,357,000	\$10,071,000
<i>Scenario 2</i>				
<b>Assumption of Catch Area Closed</b>	<b>Economic Impacts Across Potential Critical Habitat (Annual)</b>			
	<b>Area 1</b>	<b>Area 2</b>	<b>Area 3</b>	<b>Total Habitat</b>
Catch Area 4	\$0	\$0	\$29,000	\$29,000
Catch Area 5	\$0	\$0	\$6,104,000	\$6,104,000
Catch Area 6	\$0	\$0	\$524,000	\$524,000
Catch Area 7	\$6,110,000	\$0	\$0	\$6,110,000
Catch Area 8	\$0	\$3,697,000	\$0	\$3,697,000
Catch Area 9	\$0	\$120,000	\$0	\$120,000
Catch Area 10	\$0	\$2,629,000	\$0	\$2,629,000
Catch Area 11	\$0	\$1,973,000	\$0	\$1,973,000
Catch Area 13	\$0	\$900,000	\$0	\$900,000
Note: Totals may not sum due to rounding.				

## SECTION 3

## WATER QUALITY MANAGEMENT

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### 3.1 Summary of Impacts/Background

Activities in Puget Sound that may affect killer whales by compromising water quality include oil spills, disposal of chemical compounds in industry, agriculture, households, urban runoff, atmospheric deposition, leachate from landfills, effluent from wastewater treatment plants, disposal of dredge material, and other water pollution activities. Compromised water quality can affect killer whales through reduction of prey populations, bioaccumulation of contaminants in prey, and direct health effects.<sup>33</sup> The killer whales' position at the top of the food chain makes them vulnerable to higher accumulation of contaminants.

Estimating impacts of modifications to water quality management is difficult, as it is unclear what contaminant thresholds NOAA Fisheries may request in consideration of the whales. The issue is further complicated by the ambiguity of the necessary geographic scope of any potential modifications. That is, contaminant sites throughout the entire watershed, as well as through atmospheric deposition, may affect the water quality within the potential critical habitat area. Thus, the analysis identifies and locates existing point source contamination areas and locations of recent oil spills in relation to potential critical habitat for the whales. The analysis also discusses regulatory discharge limits on contaminants and pesticides, as well as potential limits on unregulated contaminants such as flame retardants. However, estimates of likely or potential impacts on water quality are not quantified.

### 3.2 Regulatory Environment

Water quality regulation is based on standards set by the Washington Department of Ecology (WDOE), according to criteria specified by the EPA. These standards are defined in the Water Quality Standards for Surface Waters of the State of Washington (Standards).<sup>34</sup> The Standards set thresholds for disposal and use of certain chemicals such as PCBs and DDT, but other chemicals such as PCDEs (flame retardants) are not currently regulated. WDOE

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<sup>33</sup> National Marine Fisheries Service, "Conservation Plan for Southern Resident Killer Whales (Preliminary Draft)," March 2005.

<sup>34</sup> Washington State Website, Access Washington, "Water Quality Standards for Surface Waters of the State of Washington," [http://www.ecy.wa.gov/programs/wq/swqs/rev\\_rule.html](http://www.ecy.wa.gov/programs/wq/swqs/rev_rule.html), accessed on August 3, 2005.

periodically updates these standards, and EPA reviews any changes during a triennial review of the State water quality standards. This triennial review is subject to section 7 consultation due to the EPA's oversight. The EPA considers effects on aquatic life in establishing national water quality criteria for toxics.

The Standards were most recently updated in 2003 and are currently subject to an ongoing EPA review.<sup>35</sup> While EPA has approved some Standards, certain Standards (primarily temperature and oxygen criteria) are still under review. NOAA Fisheries consulted with EPA on Water Quality Standards in the State of Oregon that specifically addressed temperature, dissolved oxygen and pH issues related to salmonid species in 1999 and 2004.<sup>36</sup> To address issues raised in the ESA consultation on its 1999 approval action, EPA proposed an intergovernmental project to develop guidance for water temperature criteria for use in the Pacific Northwest. This effort culminated in the issuance of the EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards, again focused on salmonid issues. It is unclear whether NOAA Fisheries or EPA would initiate consultation on review of water quality standards related to killer whale issues following listing and proposal of critical habitat. If toxics standards were changed in the habitat area, however, section 7 consultation may occur in consideration of effects on whales and their habitat.<sup>37</sup>

The Puget Sound Water Quality Protection Act ("Water Quality Act") established the formation of the Puget Sound Action Team and the Puget Sound Council. The Water Quality Act required the Action Team to publish a Puget Sound Work Plan and Management Plan.<sup>38</sup> The Management Plan explains current regulation and future plans to improve water quality within a number of water quality areas. The Puget Sound Water Quality Work Plan details how many of the Management Plan activities are funded.

### **3.3 Contaminants**

Several studies have examined the levels of contaminants in killer whales with varied results. Although DDT and PCB usage was banned in the U.S. in the 1970s, remaining contamination in the marine environment and further contamination from other parts of the world still affect the whales. As previously stated, the whales' position at the top of the food chain causes them to accumulate high concentrations of these contaminants. Further, over the last several decades, contamination levels from PBDE's (flame retardants) have doubled every four to six years due to unregulated usage of the chemicals. The level of contamination in

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<sup>35</sup> Ibid.

<sup>36</sup> NOAA Fisheries, "Biological Opinion on EPA's Proposed Approval of Revised Oregon Water Quality Standards for Temperature, Intergravel Dissolved Oxygen, and Antidegradation Implementation Methods," February 23, 2004; NOAA Fisheries, "Biological and conference opinion on EPA's approval of Oregon's water quality standards for dissolved oxygen, temperature and pH, and accompanying conservation measures," July 7, 1999.

<sup>37</sup> Personal communication with Mark Hicks, Washington Department of Ecology, Water Quality Standards Coordinator, August 18, 2005.

<sup>38</sup> Puget Sound Action Team, "Puget Sound Water Quality Protection Act (as amended in 1999)," [http://www.psat.wa.gov/Who\\_we\\_are/Protect\\_act.htm](http://www.psat.wa.gov/Who_we_are/Protect_act.htm), accessed on July 27, 2005.

southern resident killer whales was higher than in northern residents.<sup>39</sup> The EPA is currently developing criteria for eight contaminants (atrazine, ammonia, copper, diazinon, lead, nonylphenol, selenium, and silver) in consideration of aquatic life.<sup>40</sup>

Under the Clean Water Act, the State of Washington must identify water bodies that do not meet State water quality standards for regulated contaminants. These water bodies are then added to the State's section 303(d) list of impaired waters, prioritized, and then total maximum daily load (TMDL) levels are determined for each contaminant whose level exceeds state standards. EPA reviews and approves lists of impaired waters and specific TMDLs. The EPA may consult with NOAA Fisheries regarding TMDLs being established for 303(d) streams listed for aquatic life criteria impairments. Overall, 192 waters in the Puget Sound watershed are on the Section 303(d) List. Aquatic life criteria have been established for six of the contaminants/contaminant groups in Puget Sound that NOAA Fisheries has identified as being a concern to killer whales. Contaminants with existing aquatic life limits are found in 48 (25 percent) of the impaired waters in Puget Sound. Overall, 122 of the 192 impaired waters (63 percent) are impaired by contaminants of concern to killer whales.

NOAA states that the three elements that are considered to be of greatest concern to cetaceans are mercury, cadmium, and lead. In addition, PCBs, polycyclic aromatic hydrocarbons, pesticides, dioxins, and furans are a concern.<sup>41</sup> Exhibit 3-1 presents a detailed list of impaired waters in Puget Sound as well as corresponding aquatic health and human health criteria.

Exhibit 3-2 presents a summary of the number of impaired waters that lie in areas upland of the potential critical habitat for the whales. The number of impaired waters near potential habitat may give an indication of the intensity of need for water quality improvements in the three habitat areas. The number of waters was estimated for areas less than one mile from potential critical habitat, less than five miles from potential critical habitat, and for the "region" each critical habitat area is in.<sup>42</sup> These various buffer distances are intended to capture potential regional water quality issues that may exist. As shown, the largest number of impaired waters occur in Area 2 (Fall/Winter Area) in all three distance measurements. This seems logical, as major population centers are included in Area 2, including Seattle. Exhibit 3-3 presents these data in map format.

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<sup>39</sup> National Marine Fisheries Service, "Conservation Plan for Southern Resident Killer Whales (Preliminary Draft)," March 2005.

<sup>40</sup> U.S. EPA, "Water Quality Criteria: Aquatic Life," accessed at <http://www.epa.gov/waterscience/criteria/aqlife.html> on August 24, 2005.

<sup>41</sup> NOAA Fisheries, "Preliminary Draft Conservation Plan for Southern Resident Killer Whales (*Orcinus orca*)," March 2005.

<sup>42</sup> Region 1 includes San Juan, Skagit, and Whatcom Counties. Region 2 includes Island, Jefferson, King, Kitsap, Mason, Pierce, Skagit, Snohomish, and Thurston Counties. Region 3 includes Clallam, Island, and Jefferson Counties. Regional estimates of activities may not be summed, as some counties occur in more than one region. Note that the number of rivers is an estimate based on a GIS overlay of "major" river segments with potential critical habitat areas. Thus, the number of rivers may be underestimated in some cases.



**Exhibit 3-1**

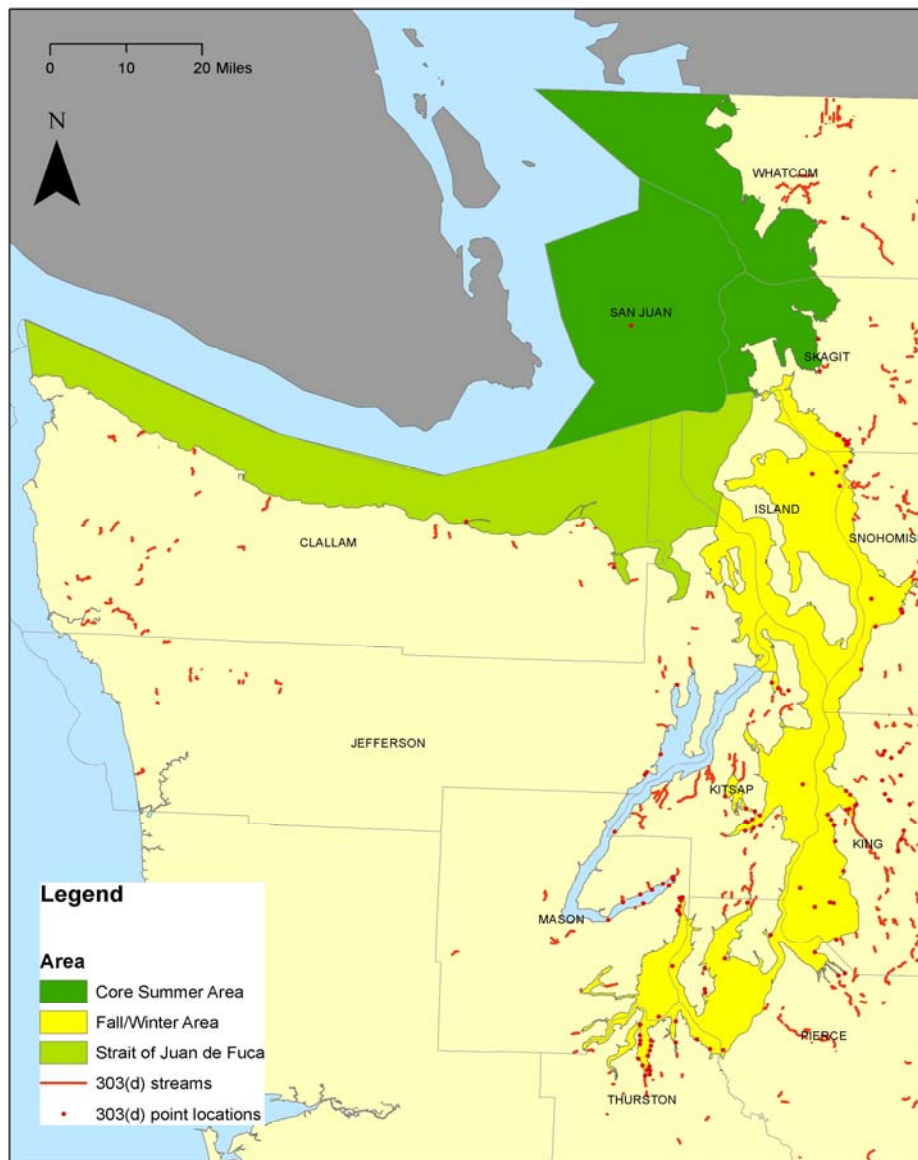
**WATERS IN PUGET SOUND IMPAIRED BY CONTAMINANTS OF POTENTIAL  
CONCERN TO KILLER WHALES**

<b>Contaminant</b>	<b>Number of Impaired Waters in Puget Sound</b>	<b>Aquatic Life Criteria (CCC µg/L)</b>	<b>Human Health Criteria (µg/L)</b>
Polychlorinated Biphenyls (PCBs)	7	0.03	0.00017
<b>Dichlorodiphenyltrichloroethane</b>			
DDT	0	0.001	0.00059
DDE	0	-	0.00059
DDD	0	-	0.00083
Polybromodiphenyl Ethers (PBDEs)	-	-	-
Dioxins (PCDDs)	0	-	1.3E-8
Furans (PCDFs)	-	-	-
<b>Polynuclear Aromatic Hydrocarbons</b>			
Naphthalene	4	-	-
Acenaphthylene	1	-	-
Acenaphthene	8	-	1,200
Fluorene	8	-	1,300
Phenanthrene	8	-	-
Anthracene	3	-	9,600
Fluoranthene	7	-	300
Pyrene	1	-	960
Benz(a)anthracene	5	-	0.0044
Chrysene	8	-	0.0044
Benzo(b+k)fluoranthene	3	-	0.0044
Benzo(a)pyrene	5	-	0.0044
Indeno(1,2,3,-c,d)pyrene	7	-	0.0044
Dibenzo(a,h)anthracene	1	-	0.0044
Benzo(g,h,i)perylene	5	-	-
Arsenic	17	36	0.018
Cadmium	8	9.3	-
Mercury	12	0.94	0.05
Tributyltin	-	-	-
<b>Pesticides and Herbicides</b>			
Chlordane	-	-	-
Dieldrin	4	0.0019	0.00014
Heptachlor	-	-	-
Lindane (gamma-BHC)	-	-	-
<p>Note: The criterion continuous concentration is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.  Sources: EPA. National Recommended Water Quality Criteria-Correction. April 1999; EPA. Section 303(d) List Fact Sheet for Watershed Puget Sound. Accessed at:  <a href="http://oaspub.epa.gov/pls/tmdl/huc_rept.control?p_huc=17110019&amp;p_huc_desc=PUGET%20SOUND">http://oaspub.epa.gov/pls/tmdl/huc_rept.control?p_huc=17110019&amp;p_huc_desc=PUGET%20SOUND</a>.</p>			

Exhibit 3-2				
NUMBER OF RIVERS AND IMPAIRED WATERS IN VICINITY OF POTENTIAL CRITICAL HABITAT FOR THE WHALES				
Critical Habitat Area	Distance to Potential Critical Habitat	Number of Major Rivers*	Number of Impaired Waters (303d)	Percent Impaired
Area 1: Core Summer Area	< 1 Mile	12	5	43%
	<5 Miles	35	15	43%
	Region 1	295	100	53%
Area 2: Fall/Winter Area	< 1 Mile	50	77	100%*
	< 5 Miles	208	263	100%*
	Region 2	731	421	58%
Area 3: Strait of Juan de Fuca	< 1 Mile	21	9	43%
	< 5 Miles	47	21	45%
	Region 3	189	66	43%
Sources: Washington Department of Ecology "Major Rivers of Washington Plus" Subset of rivers that appear on USGS 1:100,000 scale maps (and from the WARIS library). Environmental Protection Agency. Rivers, lakes, and estuaries designated under section 303(d) of the Clean Water Act. NHS index locations for 303(d) listed waters, 2002.				
* Note that the number of rivers is an estimate based on a GIS overlay of river segments with potential critical habitat areas. Because these statistics were developed from independent data sources, the number of impaired waters appears to be larger than the number of rivers in the vicinity of potential critical habitat in two cases. Most likely, the number of rivers are underestimated for these areas.				
Regional estimates of activities may not be summed, as some counties occur in more than one region: (Region 1: San Juan, Skagit, Whatcom Counties. Region 2: Island, Jefferson, King, Kitsap, Mason, Pierce, Skagit, Snohomish, Thurston Counties. Region 3: Clallam, Island, Jefferson Counties.)				

### Exhibit 3-3

#### RIVERS AND IMPAIRED WATERS IN VICINITY OF POTENTIAL CRITICAL HABITAT FOR THE WHALES



Sources: Washington Department of Ecology "Major Rivers of Washington Plus" Subset of rivers that appear on USGS 1:100,000 scale maps (and from the WARIS library). Environmental Protection Agency. Rivers, lakes, and estuaries designated under section 303(d) of the Clean Water Act. NHS index locations for 303(d) listed waters, 2002.

### **3.4 National Pollutant Discharge Elimination System**

Under the National Pollutant Discharge Elimination System (NPDES) program, EPA sets pollutant-specific limits on the point source discharges for major industries and provides permits to individual point sources that apply to these limits. According to a 2001 Memorandum of Agreement between the EPA, National Marine Fisheries Service (NMFS), and the Fish and Wildlife Service, the EPA has provided States and Tribes authority over their Clean Water Act permitting when appropriate.<sup>43</sup> In Washington, direct sewage dischargers and municipalities with storm water runoff must obtain a NPDES Permit from the WDOE for non-Federal facilities and from the EPA for Federal facilities. The WDOE also issues permits for discharges to sewers and to the ground, as discussed in the next section.<sup>44</sup>

Although development and implementation of State water quality standards are subject to a section 7 consultation between NOAA and the EPA, as an added precaution, NOAA may review each individual NPDES permit application to confirm that listed species are not adversely affected by water quality impacts. If the proposed permit does not appear to meet State water quality standards, NOAA may object to issuance of the permit, and the State may ask the applicant to alter the permit to meet the standards.

In Washington, direct sewage dischargers and municipalities with storm water runoff must obtain a NPDES Permit from WDOE for non-Federal facilities and from the EPA for Federal facilities. WDOE also issues permits for discharges to sewers and to the ground.<sup>45</sup> Ten municipalities around Puget Sound have combined sewer systems built prior to EPA policy against them, but all have developed reduction plans approved by WDOE. Since 1988, the average annual volume of untreated combined-sewer overflow released into state waters has decreased from 3.3 billion to 2 billion gallons.<sup>46</sup>

Exhibit 3-5 presents the numbers of NPDES permit areas in the vicinity of potential critical habitat between 2001 and 2003. NPDES Permit Areas are areas holding permits to discharge municipal and industrial wastes to surface water. While these counts represent past permit locations, the general pattern of permitting locations is likely to continue into the future. Similar to the number of impaired waters, the number of NPDES permits is also largest in Area 2 (Fall/Winter Area) over this time period. At distances of less than one mile from potential critical habitat, Area 2 has nearly three times as many permits as Areas 1 and ten times as many permits as granted in Area 3.

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<sup>43</sup> U.S. Environmental Protection Agency, Department of the Interior, and the Department of Commerce, Memorandum of Agreement Between the Environmental Protection Agency, Fish and Wildlife Service and National Marine Fisheries Service Regarding Enhanced Coordination Under the Clean Water Act and Endangered Species Act; Notice, Federal Register Vol. 66, No. 36, February 22, 2001.

<sup>44</sup> State of Washington Puget Sound Water Quality Action Team, "Puget Sound Water Quality Management Plan," Adopted December 14, 2000, page 44.

<sup>45</sup> Ibid, page 44.

<sup>46</sup> Ibid, page 99.

<b>Exhibit 3-5</b> <b>NUMBER OF NPDES PERMITS IN THE VICINITY OF POTENTIAL CRITICAL HABITAT FOR THE WHALES (2001-2003)</b>		
<b>Critical Habitat Area</b>	<b>Distance to Potential Critical Habitat</b>	<b>Number of Permits</b>
Area 1: Core Summer Area	< 1 Mile	85
	<5 Miles	164
	Region 1	202
Area 2: Fall/Winter Area	< 1 Mile	202
	< 5 Miles	576
	Region 2	651
Area 3: Strait of Juan de Fuca	< 1 Mile	20
	< 5 Miles	93
	Region 3	93
Source: National Pollutant Discharge Elimination System (NPDES) Permit Areas GIS data, 2003. Environmental Affairs Office, Washington State Department of Transportation. Polygons depict National Pollutant Discharge Elimination System (NPDES) Permit Areas in Washington State. Regional estimates of activities may not be summed, as some counties occur in more than one region: Region 1: San Juan, Skagit, Whatcom Counties. Region 2: Island, Jefferson, King, Kitsap, Mason, Pierce, Skagit, Snohomish, Thurston Counties. Region 3: Clallam, Island, Jefferson Counties.		

Changes to discharge permits that may be required to accommodate killer whales are unknown at this time. However, were they to be imposed, the goals would likely be to reduce bioaccumulation of toxics in whales. Changes to permit parameters (e.g., temperature controls) have been made to increase salmon survivorship in the past.

### **3.5 WDOE and WDOT-Permitted Facilities**

As stated above, direct sewage dischargers and municipalities with storm water runoff must obtain a NPDES Permit from the WDOE for non-Federal facilities and from the EPA for Federal facilities in Washington State. The WDOE also issues permits for discharges to sewers and to the ground.<sup>47</sup> Exhibit 3-6 presents data on the number of permitted water discharges (including NPDES permits), other permitted facilities (such as air quality permits), and clean-up sites (including Superfund sites). There is likely to be overlap between the permitted water discharges included in Exhibit 3-4 and the NPDES permitted facilities in Exhibit 3-6. As with other water quality issues, Area 2 has the largest number of permits that could lead to water quality impacts.

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<sup>47</sup> Ibid, page 44.

Exhibit 3-6				
NUMBER OF WASHINGTON DEPARTMENT OF ECOLOGY-PERMITTED FACILITIES IN VICINITY OF POTENTIAL CRITICAL HABITAT FOR THE WHALES				
Critical Habitat Area	Distance to Potential Critical Habitat	Permitted Water Discharges	Other Permitted Facilities	Cleanup Sites (Includes Superfund)
Area 1: Core Summer Area	< 1 Mile	61	399	311
	<5 Miles	132	798	541
	Region 1	187	1,318	857
Area 2: Fall/Winter Area	< 1 Mile	232	5,172	268
	< 5 Miles	648	17,276	764
	Region 2	715	12,713	6,295
Area 3: Strait of Juan de Fuca	< 1 Mile	33	135	134
	< 5 Miles	93	467	434
	Region 3	108	481	490
Washington State Department of Ecology, Facility/Site Database GIS layer, June 2003. <a href="http://www.ecy.wa.gov/services/gis/data/data.htm#facility">http://www.ecy.wa.gov/services/gis/data/data.htm#facility</a> . Regional estimates of activities may not be summed, as some counties occur in more than one region: Region 1: San Juan, Skagit, Whatcom Counties. Region 2: Island, Jefferson, King, Kitsap, Mason, Pierce, Skagit, Snohomish, Thurston Counties. Region 3: Clallam, Island, Jefferson Counties.				

Washington State Department of Transportation maintains an inventory of all sites where highway storm runoff is discharged from WSDOT right-of-way to surface water bodies, to ground water via dry wells, and by infiltration. Stormwater outfalls are often seen as culprits of non-point source pollution, particularly where highways run off into water bodies. While stormwater outfalls may or may not be consulted on by NOAA Fisheries associated with killer whales, an inventory of highway stormwater outfalls is presented in Exhibit 3-7. As with the other permit types, stormwater outfalls are most dense in Area 2.

<b>Exhibit 3-7</b>		
<b>NUMBER OF WASHINGTON DEPARTMENT OF TRANSPORTATION- TRACKED HIGHWAY STORMWATER OUTFALLS IN VICINITY OF POTENTIAL CRITICAL HABITAT FOR THE WHALES</b>		
<b>Critical Habitat Area</b>	<b>Distance to Potential Critical Habitat</b>	<b>Number of Highway Stormwater Outfalls</b>
Area 1: Core Summer Area	< 1 Mile	27
	<5 Miles	212
	Region	333
Area 2: Fall/Winter Area	< 1 Mile	598
	< 5 Miles	2,493
	Region	3,268
Area 3: Strait of Juan de Fuca	< 1 Mile	2
	< 5 Miles	12
	Region	13
Sources: Washington State Department of Transportation, Stormwater Outfall Along Washington State Routes, 2005. Points represent stormwater outfalls along Washington State Department of Transportation state routes.		

### 3.6 Oil Spills

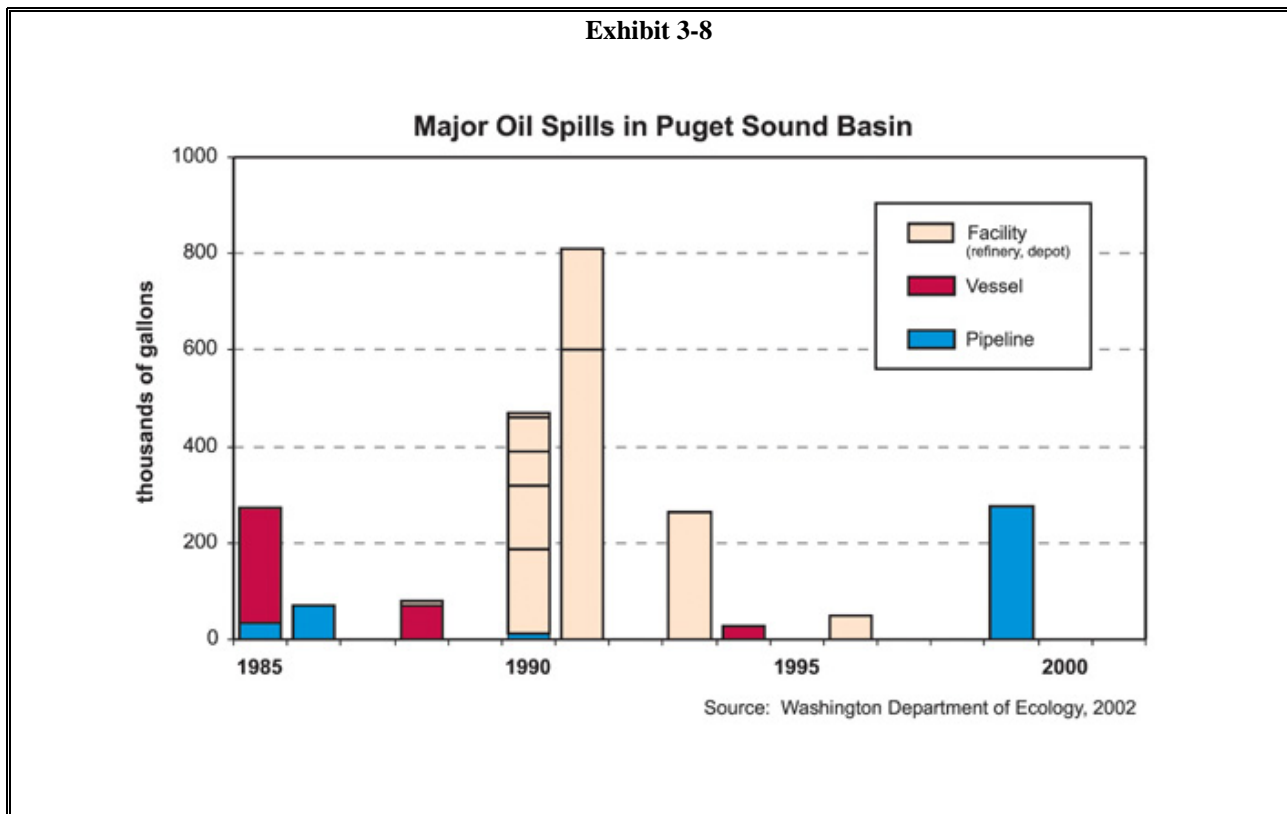
Major oil spills are potentially catastrophic to marine species, and long-term exposure to petroleum hydrocarbons released as part of oil spills are a potential threat to killer whales. Puget Sound is not far from Alaska's crude oil supply and is therefore one of the leading petroleum refining centers in the U.S. While oil is carried via water, rail, highway, and pipeline, marine transportation appears to pose the largest threat to Puget Sound marine areas. Between 1985 and 2001, 16 major spills from facilities, pipelines, vessels and barges released more than 2.3 million gallons of oil into the Sound. The number of major spills has decreased recently, with the most recent being the Pipeline Rupture in Whatcom Creek in Bellingham in 1999, spilling about 277,000 gallons.<sup>48</sup> U.S. Coast Guard records indicate, however, that, nationally, 95 percent of oil spills are spills of less than 1,000 gallons. Exhibit 3-8 presents general data on the frequency of recent oil spills in Puget Sound.

<sup>48</sup> "Major" spills are 10,000 gallons or more. "Serious" spills are 25-10,000 gallons.

Puget Sound Water Quality Action Team, "State of the Sound 2005," <http://www.psat.wa.gov/Publications/StateSound2004/PSATSOS2004.pdf>, accessed on August 18, 2005.

Puget Sound Water Quality Action Team, "Puget Sound's Health 2002," [http://www.psat.wa.gov/Publications/pshealth2002/pshealth\\_pdf.html](http://www.psat.wa.gov/Publications/pshealth2002/pshealth_pdf.html), accessed August 5, 2005.

Exhibit 3-8



The EPA and the U.S. Coast Guard (USCG) oversee the Oil Pollution Prevention regulations promulgated under the authority of the Federal Water Pollution Control Act. Among other issues, these regulations address requirements for Spill Prevention, Control and Countermeasure Plans and Facility Response Plans for offshore and onshore oil producers and carriers. The Facility Response Plans are submitted to the USCG for the transportation-related portion of the facility and to EPA for the non-transportation portions. The National Oil and Hazardous Substances Pollution Contingency Plan (or National Contingency Plan), is the Federal government's guideline for responding to both oil spills and hazardous substance releases. The Northwest Area Contingency Plan (NWACP), developed by the Northwest Area Committee, serves as the primary guidance document for responders in Washington, Oregon, and Idaho to oil spills and hazardous materials spills. Under the NWACP, the USCG has the authority to respond to all oil and hazardous substance spills in the coastal zone, the EPA has authority to respond in the inland zone, and the state of Washington responds within state boundaries. The NWACP also contains the "Northwest Area Shoreline Countermeasures Manual and Matrices," which describes Northwest area-specific habitat and response strategies that should be recommended or conditionally recommended in case of an oil spill.<sup>49</sup>

<sup>49</sup> NOAA Fisheries, Endangered Species Act Section 7 Programmatic Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Oil Spill Response Activities Conducted Under the Northwest Area Contingency Plan (NWACP), November 6, 2003.



In 2001, an “Inter-agency Memorandum of Agreement (MOA) Regarding Oil Spill Planning and Response Activities Under the FWPCA’s National Oil and Hazardous Substances Pollution Contingency Plan and the Endangered Species Act” was signed by NOAA, USFWS, EPA, and USCG. The purpose of the MOA is to increase cooperation and understanding among agencies involved in ESA compliance at every stage in oil spill planning and response. The MOA outlines procedures to streamline the ESA compliance process before, during, and after an incident.<sup>50</sup>

In November 2003, NOAA issued a programmatic biological opinion to EPA and USCG that addressed most response actions undertaken by these agencies to limit or prevent oil discharges and their effects on listed species and their habitats. This consultation included numerous salmon species, blue whales, fin whales, humpback whales, northern right whales, sei whales, and sperm whales, among others. The consultation found that many oil spill response activities could be treated programmatically, but that some actions which were “less predictable” were identified as potentially requiring individual consultation.<sup>51</sup> This consultation may be reinitiated now that southern resident killer whales have been listed. If reinitiation does take place subsequent to the designation of critical habitat, both the “jeopardy” and “adverse modification” prohibitions of section 7 will be considered. Changes to the biological opinion for either reason are not envisioned at this time, however, and so impacts due to the designation of critical habitat are unlikely to occur.<sup>52</sup>

### **3.7 Disposal of Dredge Material**

Section 404 of the Clean Water Act (CWA) prescribes a permit program for the discharge of dredged or fill material into navigable waters at specified disposal sites. Specifically, pursuant to section 404, permit applicants are required to show that they have “taken steps to avoid wetland impacts, where practicable, minimized potential impacts to wetlands, and provided compensation for any remaining, unavoidable impacts through activities to restore or recreate wetlands.”<sup>53</sup> The most frequently exercised authority of the Rivers and Harbors Act (RHA) is in Section 10 (33 U.S.C. 403) which covers construction, excavation, or deposition of materials in, over, or under such waters, or any work which would affect the course, location, condition, or capacity of those waters.<sup>54</sup> USACE has permitting authority for this Act.

Dredging of sediment with Puget Sound is performed for various reasons, but typically is used to create or maintain bridge clearance or to facilitate navigation. It may also be

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<sup>50</sup> Ibid.

<sup>51</sup> Ibid.

<sup>52</sup> Personal communication with NOAA Fisheries, June 6, 2006.

<sup>53</sup> U.S. Environmental Protection Agency, "Section 404 of the Clean Water Act: An Overview," accessed at <http://www.epa.gov/owow/wetlands/facts/fact10.html>.

<sup>54</sup> U.S. Army Corps of Engineers, Regulatory Overview," accessed at <http://www.usace.army.mil/inet/functions/cw/cecwo/reg/oceover.htm>.

performed as part of construction projects or for environmental clean-up. Dredging typically occurs near the edge of the Sound and is therefore sometimes outside of the potential critical habitat for the whales.<sup>55</sup>

The Dredged Material Management Program (DMMP) is a multi-agency entity responsible for management of dredged materials in the State of Washington. The cooperating agencies include the Seattle District USACE, United States Environmental Protection Agency (EPA) Region 10, and the Washington Departments of Ecology (WDOE) and Natural Resources (WDNR).<sup>56</sup> The WDNR, through its DMMP office, oversees all dredged sediment disposal activities occurring on State aquatic lands. According to the DMMP framework, the Puget Sound area operates according to the Puget Sound Dredged Disposal Analysis program (PSDDA), which manages disposal within Puget Sound and the Strait of Juan de Fuca.<sup>57</sup>

Any dredging that involves open-water sediment disposal in the potential habitat area, even if performed near-shore, may compromise the quality of the whales' habitat. Due to human safety and water quality concerns, contaminated sediment is typically already required to be disposed at an upland site, which can cost up to \$25 million or more for the largest dredging projects.<sup>58</sup> Alternative disposal methods for contaminated dredge material are considered baseline protections in this analysis.

The sediment dredged in the potential critical habitat area is usually considered clean (as opposed to contaminated sediment that may be dredged as part of an environmental clean up). It may therefore legally be disposed of in open water.<sup>59</sup> As the threat of disposal of clean sediment in open water is potential physical harm to the whales, and not modification of their habitat, NOAA Fisheries considers this to be a jeopardy issue. That is, the impact of using alternative disposal sites for clean dredge material is not considered to be a co-extensive impact, and is treated as part of the baseline stemming from the listing (jeopardy alone) of the species.<sup>60</sup>

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<sup>55</sup> Personal Communication, Laura Praye, Habitat Biologist, Dept of Fish and Wildlife, October 4, 2005.

<sup>56</sup> Washington State Department of Natural Resources, Dredged Material Management Program (DMMP), Program Overview. Accessed at <http://www.dnr.wa.gov/htdocs/aqr/dmmp/> on September 20, 2005.

<sup>57</sup> There are two other location-specific programs: (1) The Grays Harbor / Willapa Bay Dredged Disposal Analysis Program manages disposal of dredged materials in those coastal embayments. (2) The Columbia River Disposal Program manages the disposal of dredged materials on the Washington side of the river.

<sup>58</sup> Written communication, Doug Hotchkiss, Project Manager, Port of Seattle, September 19, 2005.

<sup>59</sup> Washington Annotated Code 173-350-100, Solid Waste Handling Standards, Definitions, Contaminated Dredged Materials, accessed at <http://apps.leg.wa.gov/wac/default.aspx?cite=173-350&full=true> on January 11, 2006; Federal Water Pollution Control Act, 33 U.S.C 1251, Section 404, accessed at <http://www.epa.gov/region5/water/pdf/ecwa.pdf> on January 11, 2006.

<sup>60</sup> Personal communication with NOAA Fisheries, May 23, 2006.

**4.1 Impacts on Small Entities**

This section considers the extent to which results of the economic analysis result in impacts to small businesses or energy markets. The small business analysis is conducted pursuant to the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) in 1996. Potential for impacts to the energy industry, required by Executive Order No. 13211, is addressed in a separate memorandum by NOAA Fisheries.

First enacted in 1980, the RFA was designed to ensure that the government considers the potential for its regulations to unduly inhibit the ability of small entities to compete. The goals of the RFA include increasing the government's awareness of the impact of regulations on small entities and to encourage agencies to exercise flexibility to provide regulatory relief to small entities.

Each of the four activities described above may be modified by the listing and critical habitat designation for the whales. In turn, industries related to these activities may experience economic impacts. In determining the universe of entities to be considered in this Initial Regulatory Flexibility Analysis, Exhibit 4-1 includes only those entities that may be directly regulated by the proposed action.

At the present time, insufficient information exists regarding the cost structure and operational procedures and strategies in the sectors that may be directly impacted by the potential critical habitat designation. Further, significant uncertainty exists regarding how NOAA Fisheries may regulate industries through section 7 of the Act. Information in this IRFA is therefore provided for context on the small business climate of the region, and not as exact estimates of the impacts of potential critical habitat to individual businesses.

The following describes how entities in these industries may be directly affected by regulation related to potential critical habitat designation for the whales.

## **Fisheries**

*Fishing, Hunting, and Trapping* - Section 2 of this report describes hypothetical regulatory scenarios to provide NOAA Fisheries with information on the potential impact of regulation on the fishing industry within the potential critical habitat for the whales. As described in this section the impacts to industries on the fishing industry, and therefore any small businesses within, is highly dependent upon the regulatory scenario assumed. Assuming reductions in catch allowed, the annual impact across all regulated fishers may be anywhere between \$1.0 million if a five percent reduction in catch is assumed, or \$10.1 million in a 50 percent reduction in catch is assumed. If NOAA regulates by closing particular catch areas, the annual impact may vary from \$29,000 if Catch Area 4B is closed to \$6.1 million with the closure of Catch Area 5. These impacts may be borne across any number of the 344 total entities engaging in fishing activities in the region; 332 of these entities are considered small.

## **Water Quality Management**

*Beef Cattle Ranching & Farming; Water Supply and Irrigation Systems; Sewage Treatment Facilities; Petroleum and Coal Products Manufacturing; Petrochemical Manufacturing* - As described in Section 3 of this analysis, uncertainty exists regarding potential changes to permitted water quality management that may be requested through section 7 consultation regarding the whales. Section 3 of this report therefore provides context regarding the distribution of regulated pollutant discharge sites across the potential designation, but does not estimate impacts of modifications to these permitted activities. If NOAA Fisheries requested stricter water quality parameters on permitted activities, industries in need of water quality permitting may be impacted. Estimates of the number of potentially regulated businesses in these industries are included in Exhibit 4-1.

### **4.2 Small Entity Profile of Potential Critical Habitat**

Exhibit 4-1 identifies industries by North American Industry Classification System (NAICS) and highlights the number of total businesses and small businesses within these relevant industries in the counties adjacent to the potential critical habitat.

Exhibit 4-2 highlights industries that may experience downstream economic impacts of conservation efforts for the whales. These industries are not expected to be directly regulated by NOAA Fisheries. Costs of modifications to directly regulated activities, however, may be passed on to these industries as their operations are related to the regulated entities. For example, while NOAA Fisheries may not be concerned with the impact of seafood processing on the whales and their habitat, any regulation of the commercial fishing industry that results in decreased production may impact these businesses. Exhibit 4-3 presents the small business thresholds used to identify the number of small businesses within each NAICS code classification. These are the most recent thresholds, which became effective December 5, 2005.<sup>61</sup>

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<sup>61</sup> 13 CFR Parts 121 and 123, Small Business Size Standards Inflation Adjustment to Size Standards; Business Loan Program; Disaster Assistance Loan Program. Interim final rule with request for comments. Federal register Vol. 70, No. 233.

**Exhibit 4-1**

**TOTAL NUMBER OF SMALL BUSINESSES THAT MAY BE REGULATED BY SECTION 7 CONSULTATION  
ASSOCIATED WITH POTENTIAL KILLER WHALE CRITICAL HABITAT DESIGNATION**

			County														
NAICS	Activity		San Juan	Clallam	Jefferson	Mason	Thurston	Pierce	King	Kitsap	Island	Snohomish	Skagit	Whatcom	Total	% Small	
Industries Potentially Effected by Changes in Fisheries																	
114	Fishing, Hunting, Trapping	Total	4	7	13	15	10	18	130	17	7	49	31	43	344		
		Small	4	7	13	15	10	18	120	17	7	49	30	42	332	97%	
Industries Potentially Effected by Changes in Water Quality Management																	
112111	Beef Cattle Ranching & Farming	Total	0	3	3	4	27	21	19	2	7	22	19	30	157		
		Small	0	3	3	4	27	21	18	2	7	22	19	28	154	98%	
22131	Water Supply and Irrigation Systems	Total	10	15	2	13	23	24	64	15	31	31	6	29	263		
		Small	10	15	2	13	22	24	59	14	31	30	5	29	254	97%	
221320	Sewage Treatment Facilities	Total	1	0	0	1	2	3	17	2	1	2	2	2	33		
		Small	1	0	0	0	1	2	12	2	1	2	1	2	24	73%	
3241	Petroleum and Coal Products Manufacturing	Total	0	0	0	0	1	4	13	0	1	7	1	5	32		
		Small	0	0	0	0	0	4	12	0	1	6	1	5	29	91%	
32511	Petrochemical Manufacturing	Total	0	0	0	0	0	0	1	0	0	1	0	0	2		
		Small	0	0	0	0	0	0	1	0	0	1	0	0	2	100%	

Source: Compiled by IEc with information from the Small Business Association and Dun & Bradstreet.

**Exhibit 4-2**

**TOTAL NUMBER OF SMALL BUSINESSES THAT MAY BE INDIRECTLY AFFECTED BY ACTIVITIES REGULATED  
BY SECTION 7 CONSULTATION ASSOCIATED WITH POTENTIAL KILLER WHALE CRITICAL HABITAT DESIGNATION**

			County															
NAICS	Activity		San Juan	Clallam	Jefferson	Mason	Thurston	Pierce	King	Kitsap	Island	Snohomish	Skagit	Whatcom	Total	% Small		
Industries Potentially Effectuated by Changes in Fisheries																		
11251	Animal Aquaculture	Total	4	5	4	10	13	14	24	4	3	8	7	13	109			
		Small	1	4	3	7	13	13	20	4	2	8	7	13	95	87%		
112511	Finfish Farming and Fish Hatcheries	Total	2	4	3	2	11	14	19	4	1	8	7	13	88			
		Small	0	3	3	1	11	13	16	4	1	8	7	13	80	91%		
112512	Shellfish Farming	Total	1	0	0	5	1	0	0	0	2	0	0	0	9			
		Small	1	0	0	5	1	0	0	0	1	0	0	0	8	89%		
112519	Other animal Aquaculture	Total	1	1	1	3	1	0	5	0	0	0	0	0	12			
		Small	0	1	0	1	1	0	4	0	0	0	0	0	7	58%		
1129	Other Animal Production	Total	8	9	4	9	47	69	109	30	9	71	21	30	416			
		Small	8	9	4	9	45	67	104	30	9	71	19	27	402	97%		
31171	Seafood Product Preparation and Packaging	Total	0	2	2	3	2	7	82	2	0	17	6	29	152			
		Small	0	1	1	3	2	5	61	2	0	8	3	20	106	70%		
311711	Seafood Canning	Total	0	0	1	2	0	4	18	2	0	6	2	11	46			
		Small	0	0	1	2	0	2	16	2	0	4	1	9	37	80%		
311712	Fresh and Frozen Seafood Processing	Total	0	2	1	1	2	3	64	0	0	11	4	18	106			
		Small	0	1	0	1	2	3	45	0	0	4	2	11	69	65%		
424460	Fish and Seafood Merchant Wholesalers	Total	3	11	8	23	12	21	196	16	6	35	17	30	378			
		Small	3	11	8	22	12	19	176	14	5	32	17	26	345	91%		

Source: Compiled by IEC with information from the Small Business Association and Dun & Bradstreet.

**Exhibit 4-3**

**SMALL BUSINESS THRESHOLDS BY NAICS CODE**

<b>NAICS</b>	<b>Activity Description</b>	<b>Revenue</b>	<b>Employees</b>	<b>Notes</b>
112111	Beef Cattle Ranching & Farming	\$750,000		
11251	Animal Aquaculture	\$750,000		
112511	Finfish Farming and Fish Hatcheries	\$750,000		
112512	Shellfish Farming	\$750,000		
112519	Other animal Aquaculture	\$750,000		
1129	Other Animal Production	\$750,000		
114	Fishing, Hunting, Trapping	\$4,000,000		
22131	Water Supply and Irrigation Systems	\$6,500,000		
221320	Sewage Treatment Facilities	\$6,500,000		
31171	Seafood Product Preparation and Packaging		500	
311711	Seafood Canning		500	
311712	Fresh and Frozen Seafood Processing		500	
3241	Petroleum and Coal Products Manufacturing		1500	[1]
32511	Petrochemical Manufacturing		1000	
424460	Fish and Seafood Merchant Wholesalers		100	[2]
[1] Categories under this code are classified as no more than 500, 750, or 1,500 employees				
[2] For government contractors, the threshold is 500 employees.				
Source: United Small Business Administration, Table of Small Business Size Standards, <a href="http://www.sba.gov/size/sizetable2002.pdf">http://www.sba.gov/size/sizetable2002.pdf</a>				

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**APPENDIX A**  
**DEMOGRAPHIC DATA**

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**Exhibit A-1**

**ECONOMIC ACTIVITY WITHIN COUNTIES  
CONTAINING KILLER WHALE CRITICAL HABITAT: ANNUAL PAYROLL BY INDUSTRY (\$ Thousands, 2003)**

<b>Industry</b>	<b>Clallam</b>	<b>Island</b>	<b>Jefferson</b>	<b>King</b>	<b>Kitsap</b>	<b>Mason</b>	<b>Pierce</b>	<b>San Juan</b>	<b>Skagit</b>	<b>Snohomish</b>	<b>Thurston</b>	<b>Whatcom</b>	<b>TOTAL</b>	<b>% of State Total</b>
Forestry, Fishing, Hunting, and Agriculture Support	21,367	0	1,600	130,958	3,485	9,140	10,928	0	14,170	24,125	18,571	10,003	<b>244,347</b>	<b>47%</b>
Mining	0	0	0	11,437	673	0	14,260	na	0	6,057	0	0	<b>32,427</b>	<b>25%</b>
Utilities	0	1,127	382	120,730	5,983	229	30,812	0	0	1,390	4,409	0	<b>165,062</b>	<b>49%</b>
Construction	43,397	30,589	20,114	2,670,745	157,732	22,767	710,585	22,244	120,787	731,042	144,340	245,050	<b>4,919,392</b>	<b>78%</b>
Manufacturing	41,605	21,190	26,379	4,691,840	56,913	49,419	679,105	6,831	212,907	2,172,264	120,817	398,329	<b>8,477,599</b>	<b>76%</b>
Wholesale trade	10,418	0	0	3,283,909	40,765	17,806	349,158	0	43,720	320,728	86,062	110,588	<b>4,263,154</b>	<b>77%</b>
Retail trade	76,378	51,410	22,894	2,578,275	267,661	36,079	805,414	16,136	215,852	747,997	254,469	213,581	<b>5,286,146</b>	<b>72%</b>
Transportation & Warehousing	14,996	7,603	2,215	1,741,507	26,557	4,831	255,700	2,211	44,200	168,230	39,611	54,152	<b>2,361,813</b>	<b>82%</b>
Information	8,437	11,398	5,742	7,725,868	54,751	2,891	145,788	6,270	17,019	308,872	68,451	55,331	<b>8,410,818</b>	<b>94%</b>
Finance & Insurance	19,199	32,924	5,841	3,470,350	96,015	9,339	573,747	5,229	44,300	559,786	106,647	99,692	<b>5,023,069</b>	<b>83%</b>
Real Estate & Rental & Leasing	6,591	6,208	3,962	958,199	27,319	4,874	124,540	3,369	13,064	92,675	24,206	22,401	<b>1,287,408</b>	<b>84%</b>
Professional, Scientific & Technical Services	19,082	14,602	6,272	5,297,872	113,418	4,338	384,560	8,734	44,591	444,086	165,799	129,902	<b>6,633,256</b>	<b>83%</b>
Management of Companies & Enterprises	0	1,659	0	8,917,502	47,068	0	203,347	0	0	215,119	12,574	23,833	<b>9,421,102</b>	<b>97%</b>
Admin, Support, Waste Mgt., Remediation Services	6,356	9,832	3,728	2,455,436	88,706	3,861	257,688	5,061	21,242	241,863	51,376	50,456	<b>3,195,605</b>	<b>78%</b>
Educational Services	3,594	3,033	0	453,307	15,024	0	156,800	0	4,330	32,882	19,294	15,474	<b>703,738</b>	<b>74%</b>
Health Care and Social Assistance	93,712	59,658	35,336	4,101,460	314,599	38,656	1,331,241	6,386	188,432	767,147	335,277	238,530	<b>7,510,434</b>	<b>70%</b>
Arts, Entertainment & Recreation	8,767	4,689	2,260	727,314	34,345	0	102,783	3,643	16,507	93,583	41,953	18,649	<b>1,054,493</b>	<b>83%</b>
Accommodation & Food Services	25,590	17,687	11,083	1,266,777	73,964	8,914	248,408	13,105	59,694	215,911	78,561	79,480	<b>2,099,174</b>	<b>75%</b>
Other Services (except public administration)	16,099	10,669	7,212	1,127,862	55,996	7,595	261,729	2,913	34,477	197,163	90,717	60,418	<b>1,872,850</b>	<b>80%</b>
Unclassified Establishments	241	68	0	7,745	496	0	1,143	0	0	2,506	0	308	<b>12,507</b>	<b>74%</b>

Source: U.S. Census Bureau, 2003 County Business Patterns, accessed at <http://censtats.census.gov/cbpnaic/cbpnaic.shtml>.

Note: Percent of state total represents percent of state total within the listed industry classification.

**Exhibit A-2**

**ECONOMIC ACTIVITY WITHIN COUNTIES CONTAINING POTENTIAL CRITICAL HABITAT FOR THE KILLER WHALES: NUMBER OF ESTABLISHMENTS AND EMPLOYEES BY INDUSTRY (2003)**

		<b>Clallam</b>	<b>Island</b>	<b>Jefferson</b>	<b>King</b>	<b>Kitsap</b>	<b>Mason</b>	<b>Pierce</b>	<b>San Juan</b>	<b>Skagit</b>	<b>Sno-homish</b>	<b>Thurston</b>	<b>Whatcom</b>	<b>TOTAL</b>	<b>% of State Total</b>
Forestry, Fishing, Hunting, and Agriculture Support	Establishments	79	12	18	261	26	29	78	17	65	135	65	65	<b>850</b>	<b>51%</b>
	Employees	617	20-99	55	2,268	69	265	272	20-99	393	502	445	321	<b>5,207</b>	<b>37%</b>
Mining	Establishments	2	5	3	31	3	4	10	na	9	19	5	4	<b>95</b>	<b>53%</b>
	Employees	0-19	20-99	20-99	219	28	20-99	238	na	20-99	129	20-99	20-99	<b>614</b>	<b>23%</b>
Utilities	Establishments	11	15	6	42	14	6	31	8	6	11	11	15	<b>176</b>	<b>54%</b>
	Employees	20-99	50	18	1,819	126	19	600	20-99	100-249	23	93	20-99	<b>2,748</b>	<b>50%</b>
Construction	Establishments	351	343	171	5,655	893	195	2,406	218	492	2,934	784	844	<b>15,286</b>	<b>70%</b>
	Employees	1,224	984	627	55,600	4,486	604	16,720	730	3,082	18,041	3,969	6,141	<b>112,208</b>	<b>75%</b>
Manufacturing	Establishments	77	49	72	2,519	157	51	652	44	186	826	161	316	<b>5,110</b>	<b>69%</b>
	Employees	1,122	611	726	91,915	1,796	1,496	18,089	171	5,011	45,370	3,155	8,592	<b>178,054</b>	<b>72%</b>
Wholesale trade	Establishments	58	53	23	4,431	187	31	780	17	131	791	211	320	<b>7,033</b>	<b>74%</b>
	Employees	345	100-249	20-99	64,485	1,113	414	8,951	20-99	1,114	7,362	2,271	2,917	<b>88,972</b>	<b>73%</b>
Retail trade	Establishments	303	243	158	6,984	820	131	2,269	112	620	2,083	780	816	<b>15,319</b>	<b>68%</b>
	Employees	3,295	2,398	1,073	102,555	11,223	1,607	32,670	667	10,866	31,107	10,866	9,822	<b>218,149</b>	<b>70%</b>
Transportation & Warehousing	Establishments	83	35	20	1,314	100	31	479	20	96	288	138	179	<b>2,783</b>	<b>62%</b>
	Employees	507	207	60	40,995	851	180	7,219	72	1,191	4,618	1,534	1,755	<b>59,189</b>	<b>78%</b>
Information	Establishments	20	27	26	1,521	130	10	168	16	34	217	86	88	<b>2,343</b>	<b>75%</b>
	Employees	287	290	200	72,283	1,379	104	3,686	108	491	6,543	1,377	1,675	<b>88,423</b>	<b>87%</b>
Finance & Insurance	Establishments	96	85	33	3,727	305	47	964	27	167	926	305	277	<b>6,959</b>	<b>71%</b>
	Employees	544	725	168	56,746	2,212	319	9,300	123	1,076	11,606	2,711	2,392	<b>87,922</b>	<b>79%</b>
Real Estate & Rental & Leasing	Establishments	101	102	48	3,474	319	51	881	65	136	780	254	274	<b>6,485</b>	<b>74%</b>
	Employees	353	286	193	25,584	1,191	250	4,790	132	600	3,308	1,132	1,188	<b>39,007</b>	<b>79%</b>
Professional, Scientific & Technical Services	Establishments	158	153	96	8,226	626	55	1,257	90	281	1,347	511	542	<b>13,342</b>	<b>77%</b>
	Employees	646	468	223	82,912	2,873	167	8,237	207	1,346	8,899	3,503	3,279	<b>112,760</b>	<b>79%</b>



**Exhibit A-2**

**ECONOMIC ACTIVITY WITHIN COUNTIES CONTAINING POTENTIAL CRITICAL HABITAT FOR THE KILLER WHALES: NUMBER OF ESTABLISHMENTS AND EMPLOYEES BY INDUSTRY (2003)**

		<b>Clallam</b>	<b>Island</b>	<b>Jefferson</b>	<b>King</b>	<b>Kitsap</b>	<b>Mason</b>	<b>Pierce</b>	<b>San Juan</b>	<b>Skagit</b>	<b>Sno-homish</b>	<b>Thurston</b>	<b>Whatcom</b>	<b>TOTAL</b>	<b>% of State Total</b>
Management of Companies & Enterprises	Establishments	3	5	1	512	15	5	63	3	3	54	17	16	<b>697</b>	<b>79%</b>
	Employees	0-19	30	20-99	120,389	1,167	100-249	3,853	0-19	0-19	2,647	227	428	<b>128,741</b>	<b>96%</b>
Admin, Support, Waste Mgt., Remediation Services	Establishments	86	91	47	2,806	277	39	809	42	124	864	268	250	<b>5,703</b>	<b>73%</b>
	Employees	360	386	204	57,127	3,209	169	10,747	140	927	9,163	2,526	2,579	<b>87,537</b>	<b>74%</b>
Educational Services	Establishments	19	28	0	921	70	5	153	10	19	179	68	65	<b>1,537</b>	<b>77%</b>
	Employees	184	139	1	19,259	662	20-99	7,369	20-99	202	1,937	1,135	885	<b>31,773</b>	<b>71%</b>
Health Care and Social Assistance	Establishments	247	159	104	5,802	624	97	1,812	52	318	1,449	644	552	<b>11,860</b>	<b>71%</b>
	Employees	3,382	2,155	1,247	109,525	10,435	1,356	36,588	320	5,807	22,592	10,103	7,966	<b>211,476</b>	<b>69%</b>
Arts, Entertainment & Recreation	Establishments	28	39	29	920	89	18	215	41	47	183	72	100	<b>1,781</b>	<b>70%</b>
	Employees	437	304	153	22,312	1,679	500-999	4,656	181	938	3,683	2,035	1,221	<b>37,599</b>	<b>74%</b>
Accommodation & Food Services	Establishments	218	140	93	4,828	427	99	1,280	94	300	1,271	428	441	<b>9,619</b>	<b>69%</b>
	Employees	2,213	1,530	919	78,125	5,951	697	19,345	554	4,113	16,858	6,309	6,911	<b>143,525</b>	<b>71%</b>
Other Services (except public administration)	Establishments	195	139	109	5,285	505	106	1,652	51	318	1,414	531	501	<b>10,806</b>	<b>70%</b>
	Employees	954	683	411	42,253	3,088	450	12,342	163	1,677	9,374	3,712	3,279	<b>78,386</b>	<b>75%</b>
Unclassified Establishments	Establishments	5	6	1	262	15	6	71	5	13	81	20	15	<b>500</b>	<b>71%</b>
	Employees	14	6	0-19	310	30	0-19	83	0-19	0-19	155	20-99	16	<b>614</b>	<b>65%</b>
Total	Establishments	17,575	12,287 - 12,366	9,580	1,075,981	56,201	9,986	212,996	4,306 - 4,385	40,609	210,678	59,840	64,032	<b>1,774,031</b>	<b>37.5%</b>
	Employees	2,140	1,729	1,074	59,521	5,602	1,016	16,030	932	3,365	15,852	5,359	5,680	<b>118,300</b>	<b>38.3%</b>

Source: U.S. Census Bureau, 2003 County Business Patterns, accessed at <http://censtats.census.gov/cbpnaic/cbpnaic.shtml>.

Note: Percent of state total represents percent of state total within the listed industry classification.

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